OCTOBER

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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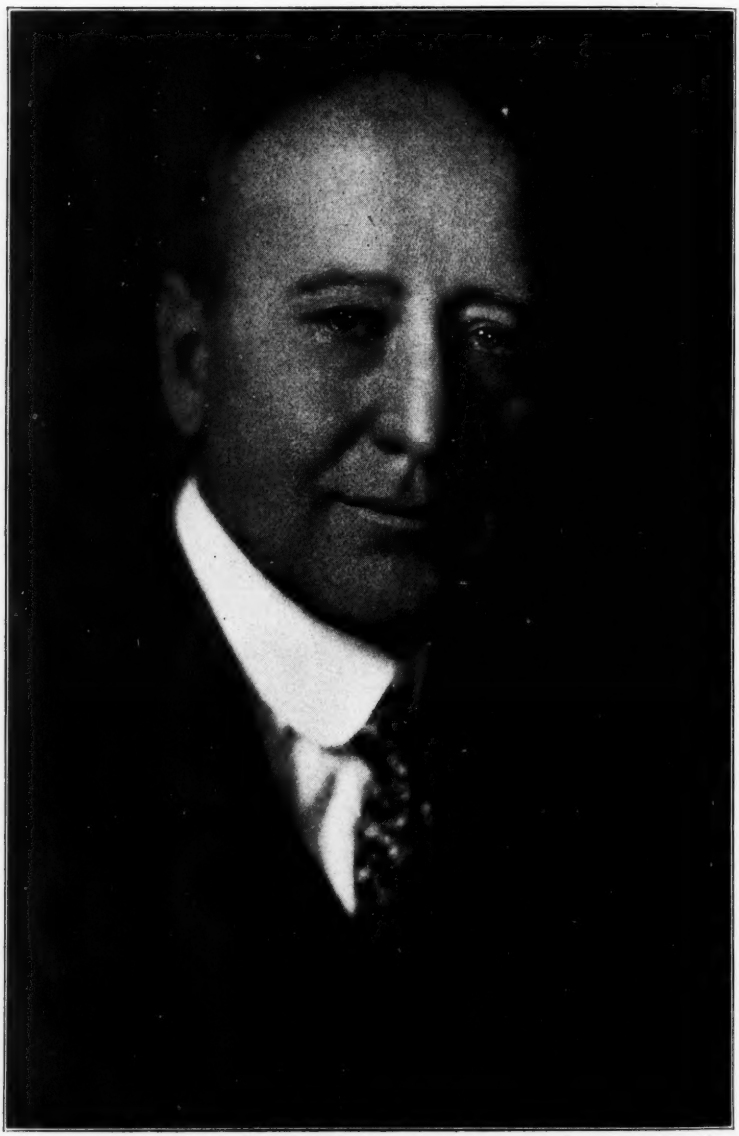

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THE JOURNAL
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Original Communications

MEDICATION IN ORAL SURGERY*

By JOSEPH E. SCHAEFER, M.D., D.D.S., Chicago, Ill.

DOWN through the centuries, men have been looking for drugs which will produce miraculous cures. Even to this day, some professional men, as well as the majority of the lay people, believe that, in some mystical way, a drug can be applied or given for some local pathologic condition, or some systemic affection, and "lo and behold," a complete restoration of the part or parts is brought about.

Because of this belief, the market is flooded with preparations claiming to achieve this or that result. Anyone who thinks in fundamentals realizes that the cure rests in the body itself, and the most that an intelligent surgeon or physician can do is to aid Nature in her processes of restoration. With this conception in mind, let us stop thinking in terms of drugs and let us think more in terms of natural processes.

How can one aid Nature intelligently, if he does not take the trouble to understand her processes? How can one treat an infective process wisely, if one does not understand the fundamental principles of inflammation and immunity? MacCallum says that, down through the ages, Nature has perfected the defensive mechanism of inflammation. It is a reaction to injury, an elaborate vascular and cellular response, bringing much blood to the part, holding in check the injurious agent, removing injured cells and eventually bringing about repair.

What is the significance of this increased blood supply? To flood the field with leukocytes and blood serum. In order to appreciate what Nature is doing in the way of an increase in the cellular elements, let us do a little calculating. The figures given here are relative: our knowledge is too limited to talk in positive terms.

We say that a normal white count runs to about 8,000 cells to a cubic millimeter of blood. It is estimated that one-thir-

*Read before the Chicago Dental Society, Dec. 17, 1929.

*The papers of Drs. Schaefer, Freeman and Molt were presented as a symposium.

teenth of the body weight in pints represents the blood volume. One-thirteenth of the weight of a man of 130 pounds is 10 pounds. So let us take 10 pints or 5 quarts and translate these in terms of the metric system.

Five quarts is roughly equivalent to 5 liters; 5 liters equals 5,000 c.c., multiplied by 10 gives us 50,000 cu. mm.; 8,000, the number of white cells in 1 cu. mm. times the total blood volume, or 50,000 cu. mm., gives us 400,000,000 white cells in a man weighing 130 pounds. A leukocytic response of 16,000 to a cubic millimeter in an acute infective process is a very ordinary one. In other words, in a very short period of time, Nature will increase the total white count to 800,000,000, an increase of 400,000,000 cells.

This increase is largely in the polymorphonuclear neutrophil type of cell; a cell magnificently equipped to destroy or devour infective elements. Well may we ask ourselves what we can do in the face of an acute infective process by the use of any medicament, that will compare with this splendid specific reaction on the part of Nature. Not only does she increase this great army of militant cells, but she also pours into the infected field immune bodies — chemical substances to neutralize the toxins of the invading bacteria.

Are these real things or blue sky speculations? The whole field of immunity rests upon the positiveness of the presence of these complex bodies in the blood, specific substances for specific invading foreign protein. The Wassermann reaction is nothing more than the demonstration of the presence of certain specific immune bodies in the blood of the patient in whom infection is suspected. The use of the antitoxins of diphtheria and tetanus, as well as the whole category of autogenesis or heterogenesis vaccines, rests upon well-established principles of immunity.

What is the significance of fever in the course of an infection? MacCallum states that it is common knowledge that fever is likely to accompany inflammation, but the efforts of physicians and healers of all sorts have been directed toward cutting it short in the belief that it in itself is the harmful process. Only in the last decade has it come to be vaguely appreciated that there is real evidence that fever, on the contrary, is a reaction elaborated to a considerable degree of perfection which aids in the defense of the body against the advance of an injurious agent by facilitating the production of the substances which are found in the body to neutralize poisons or kill bacteria. As time does not permit, I cannot give you the experimental evidence supporting the foregoing statement.

Cases Admitted to Oral Surgery Ward, Cook Co. Hospital, in Eighteen Months

Type of Case	No. of Cases
Infections about the jaws	128
New growths	108
Fractures	154
Plastic cases	65
Miscellaneous	34
Total	489

I have gone somewhat at length in this discussion to persuade you not to hope to find magical drugs which will produce magical cures, but to attempt to interpret intelligently natural processes. I have taken the subject of infections as one of the conditions of prime importance which we deal with in the field of oral surgery.

The record of admissions to the oral surgery ward at the Cook County Hospital for a period of eighteen months is given in the accompanying table.

This report is indicative of the type of cases calling for treatment in the field

of oral surgery. Fractures and plastic cases present mechanical and surgical problems primarily and do not call for any specific medication. New growths are either to be removed entirely or completely destroyed; consequently, no specific medication is indicated. This disposes of three-fourths of the cases and leaves for our consideration the problem of infections.

What are the commoner types of infections which we meet within the field of oral surgery? 1. Ulcerative gingivitis or the so-called Vincent's infection. 2. Infections about gum flaps covering lower third molars. 3. Developing alveolar abscesses. 4. Fully developed abscesses pointing in the mouth. 5. Abscesses in the floor of the mouth extending into the submaxillary triangles. 6. Bone infections or the so-called osteomyelitis of the jaws.

As the subject I am to discuss is "Medication in Oral Surgery," let us understand, before we proceed, what we mean by medication. Stedman's Medical Dictionary defines a medicament as follows: "From the Latin, meaning 'to heal'; a medicine, a medicinal application; a remedy." Let us proceed farther: "A remedy (from the Latin, meaning 'to cure'), an agent which cures disease or alleviates its symptoms." Before our definition is complete, what is meant by an agent as defined by the same authority? "An agent (from the Latin, meaning 'to perform'), anything which produces an effect on the organism, especially a remedy of any sort, whether medicinal or not."

Now, by the very definition of the subject that I am to discuss, the field is wide open. It may include surgical interference; it may include the use of physical agents, such as heat, cold, light, or, finally, it may include chemical agents. Let us think in terms of therapeutic agents in order to include any interference which we, in our judgment, with a sufficient background of knowledge of physiologic and pathologic processes, may deem necessary to the welfare of the patient, aiding him to restoration of health and well being. Let us use drugs intelligently when we believe them to have a specific effect, but, above all, let us recognize the limitations of drugs. Let us not paint a patient, making him look like an Indian, and fail to recognize some outstanding symptom, beckoning to us, begging us to recognize some fundamental pathologic process in which intelligent interference may quickly aid in bringing about the recovery of the patient. The late Bertram Sippy used to tell us that often in the making of a diagnosis, there is some outstanding symptom wigwagging, trying to attract one's attention, to tell what is wrong with the patient.

Let me illustrate more specifically: Recently, I was called in consultation by a very intelligent dentist, who had extracted three upper teeth on the advice of a physician for a patient who had been ailing for some time. The patient's resistance was low, as he had been suffering from a series of carbuncles. After the extraction of the teeth, the patient became severely ill, and the soft tissues of the palate about the sockets of the extracted teeth began to slough extensively. A diagnosis of a Vincent's infection was made, and thorough mouth hygiene was instituted.

The patient was going from bad to worse when I saw him. I at once recognized, from the general pallor and the edematous swelling under both eyes, that I was dealing with something more than a Vincent's infection. I talked with the physician on the case and he called my attention to a marked enlargement of the spleen. No blood examination had been made.

For a time, I was nonplussed. I gave some directions in the modification of the mouth treatment, realizing that, in the presence of this necrotic mass, there would, of course, be a spirochetal infection, and that all our efforts at medication of this necrotic area would be futile if we did not understand the fundamental pathology back of the sloughing process.

I recalled two cases of extensive sloughing of soft tissues of the mouth in the leukemias which I had seen at the county hospital. The enlargement of the spleen, the extreme pallor and the severe prostration fitted into such a picture. I insisted that a white count be made at once. It was found that the patient had a count of 900,000 white cells per cu. mm. of blood instead of a normal count of 8,000 or 9,000. A diagnosis of an acute leukemia was made. The patient died the following day. How futile medication for a Vincent's infection! How futile any medication in the face of such a pathologic finding!

THERAPEUTICS

Let us briefly review the treatment of infective processes as outlined above:

1. Ulcerative gingivitis, or the so-called Vincent's infection. The dyes, acriviolet or acriflavin, applied locally after drying the ulcerated lesions, followed by the use of a hydrogen peroxid, or sodium perborate mouth wash used at frequent intervals afford an effective régime of treatment for this type of infection. I do not resort to intravenous injection with arsenic unless local medication fails.

2. Acute infection about gum flaps covering erupting mandibular third molars with a marked trismus. These cases are of quite common occurrence. Hot oral irrigations for a period of fifteen minutes aid in bringing about relaxation of the stiffened muscles and permits local treatment, which consists of irrigating under the flap, followed by instillations of one of the acrid dyes into the infected pocket. I do not care what we irrigate with; the mechanical cleansing of the part is the important principle involved. For twenty years at the Cook County Hospital, there has been a nurse in charge of the gonorrheal infections of the eyes of new born infants. While on the eye service there as resident, I had occasion frequently to refer to her hapless little ones with their eyes swollen beyond recognition with pus flowing freely from the palpebral fissures and with positive gonococcus findings. There is no greater catastrophe that may happen to anyone than a gonorrheal conjunctivitis because of the great danger of scarring of the cornea followed by blindness. It is said to the credit of this very efficient nurse that she has never lost the eyesight of an infant coming under her care. And what does the treatment consist of? Saline irrigations in the severe stages of the infection at very frequent intervals. The bacteria are washed away more rapidly than they can multiply—intelligent medication.

3. Threatening abscessed teeth. Recently, one of the pathologists from Cook County Hospital came to me with this statement, "Joe, I have a tooth that I am afraid is going to abscess. It throbs tremendously and is sore to pressure, and I feel extremely toxic. Do what you think best." Inspection revealed a masterpiece of the ceramic art, a porcelain jacket crown on a poorly filled first bicuspid root. The tooth was surrounded by an area of acute inflammation, with little swelling but extremely tender to the touch. My advice was not to extract the tooth but to have the crown removed and the root canals opened. I referred him to a dentist with this request. In the course

of a half an hour, the patient returned to me with this statement, "I got relief from that severe throbbing pain as soon as the crown was removed. Pus appeared in the pulp chamber, but the dentist put in a medicament and sealed it in hermetically, and the throbbing is starting again." I immediately removed the mass of cement to afford free drainage, and instantly the throbbing pain again stopped. Here, again, faith in drugs, the hermetic sealing in of the drug, was a violation of one of the fundamental principles of surgery —ample drainage in the presence of pus. A few days later, the tooth was extracted as all symptoms had subsided. A large perforation was found at the bifurcation of the roots. The small amount of pus appearing in the pulp chamber undoubtedly was from a small abscess at the bifurcation, which probably would have rapidly spread and formed an acute alveolar abscess if the above described treatment had not been instituted.

4. A fully developed alveolar abscess. One of the first patients referred to us came in because of a deep throbbing pain in the region of the upper right bicuspids, with this history: The patient had gone to a dentist for relief of this pain, and the latter, finding some cavities in the bicuspid teeth, filled them. The pain persisted, a roentgen-ray film was taken and a completely submerged upper third molar on the same side as the pain symptoms was revealed. The case was referred to us for removal of the submerged tooth for relief of the pain. My associate saw the case first, and at once recognized that such a condition in a man, aged 45 or 50, did not fit in with the story of a deep throbbing pain coming on suddenly. He recognized a developing infective process and recommended the free application of moist heat intra-orally in the bicuspid and molar region. I saw the patient the next day. A well developed alveolar abscess was drained, with complete subsidence of all symptoms. Careful inspection of the same roentgen-ray film revealed the cause of the pain which had originally taken the patient to the dentist. Deep seated decay extending into the pulp under a large molar restoration was demonstrated with a gangrenous pulp which, no doubt, later became infected. Here, Dr. Sippy would say, was a symptom wigwagging so hard to attract attention, but completely overlooked, the blame being placed on a harmless submerged third molar. Recently, I saw a case with marked swelling of both cheeks extending into the infra-orbital tissues with marked edema here. An incision in the buccal sulcus over the right cuspid tooth had been followed by an increase in severity of all symptoms. The incision gave no relief because it was made too early. The roentgen-ray examination revealed a large area of bone destruction at the apex of the right cuspid, which was loose, and exquisitely tender to touch. Merely drilling into this tooth, with drainage of pus through the root canal, in twenty-four hours almost completely reduced the swelling of the face.

5. Recently, a patient came in with an extensive swelling about a lower first molar following the incomplete extraction of the tooth. She complained of severe pain and felt sick. Hot intral-oral tampons were recommended, with the request that she return the following day. By this time, the swelling was rapidly extending into the neck and the patient was hospitalized. Continuous hot dressings, with the use of the infra-red lamp, were prescribed. In the course of forty-eight hours, there was indication of localization. The cellulitis had extended upward as well as into the temporal region. Incision and drainage

were instituted. A small amount of foul-smelling pus was obtained. When I saw the patient the next day, she still had fever and very little pus appeared on the dressings. Recognizing that I was not dealing with the ordinary type of infection, I ordered a smear and culture taken. Myriads of the Vincent's organisms were revealed. Intravenous injections of arsphenamin were given on the basis of the bactericidal effect of arsenical preparations for the spirochetal organism. The patient rapidly improved, and left the hospital in another week.

6. The next type of infective process which I have included in my list is one which extends into the bone. It always has been interesting to me to speculate as to why so many infections which spring from dead pulps, and no doubt have their first reaction in the cancellous bone, so quickly penetrate the cortex and invade the soft tissue. One would think that the marrow spaces of the bone would be the more convenient way for these infections to extend. We are indeed fortunate that this is not the case because an acute osteomyelitis usually means death of bone, with sequestration, all of which runs a more or less protracted course. I have discussed bone infections at length in an earlier article.[2]

So far, I have discussed the acute infections which rapidly clear up under drainage and irrigation. The chronic pyogenic infections are more obstinate. Recently, two cases of this type came under my care. In one, multiple abscesses formed after a tooth extraction. When the case came into my hands, the patient was in a bad way as the pus had invaded the temporal fossa. Through and through drainage was instituted with irrigations of surgical solution of chlorinated soda (Dakin's). An autogenous vaccine was given and quartz light radiation, both local and general, was applied. In the chronic cases, it is the belief that the patient's resistance is low and he does not possess sufficient antibodies to combat the infective process, hence, the use of a vaccine, which is nothing more than the injection of a foreign protein calling forth a specific reaction. We believe that we are stimulating him to combat the invading organism by increasing his antibody production. The quartz light treatment rests on the belief that, here too, antibody formation is stimulated. Time does not permit me to go into the experimental evidence in support of this opinion. The calcium-phosphorus content of the blood is said to be raised also by this treatment. This is thought to increase the cell permeability, which aids in improving the nutrition of the cell. Much of our medicine is empiric in character because of the limitation of our knowledge. We cannot follow drug action down into the chemistry of the cell; hence, much of the final action of drug or agents is speculative in character. But people seem to be benefited by a certain course of procedure, and we feel that if this procedure is a rational one, it is a justifiable one.

Probably, one could sum up the principles of medication in oral surgery under the use of heat, light, drainage, irrigation and anodynes for the control of postoperative pain. A painful tooth socket can usually be made comfortable by some anodyne in an oil or oleaginous base, with the administration of acetylsalicylic acid and amidopyrin, in the milder cases, for their general effect. Occasionally, a hypnotic may be advisable to control nervous apprehension. Obviously, in such a short discussion of oral medication, one can only touch on principles. This I have tried to do. If I have succeeded in per-

2. Schaefer, J. E.: Osteomyelitis of the Jaws, J. A. D. A., 16: 2188 (Dec.) 1929.

suading you to stop thinking in terms of drug medication and to reflect a little more on biologic processes, I shall feel that my time has been well spent.

THE EXTRACTION OF TEETH*

By CHARLES W. FREEMAN, D.D.S., M.S., F.A.C.D., Chicago, Ill.

"THE extraction of teeth is a surgical operation." How many times has this statement been made in the past decade, and to what a variety of interpretations has it been subjected! To one man, it suggests that he is not equipped to perform this service, and he refers all extraction to a specialist. Another interprets it by investing in a complicated sterilizing equipment; habitually wears rubber gloves and a face mask; drapes the patient with a sterile sheet, and in every way attempts to reproduce the hospital operating room in his office. Still another will remark that it is "all bunk," and continue to use stock anesthetic solutions from an open bottle, immerse his hypodermic needle in a widely advertised mouth wash for sterilization and lacerate the soft tissue of the mouth with unsterilized instruments.

Is the extraction of a tooth a surgical operation? Certainly it is, for we are traumatically invading tissue with a blood supply, and rigid asepsis should be maintained. The difference in aseptic technic between the simple extraction of a single tooth and the difficult removal of an impacted tooth should be a difference not of degree but of continuance. In the one case, a single application of the instrument, and the operation is completed. The other requires frequent reapplication, and asepsis should be maintained to the end.

A true aseptic technic does not always require the elaborate preparations frequently observed. The use of rubber gloves is probably never required in a dental office except for the protection of the operator. A simple routine technic without ostentation can be developed which fulfils all the requirements in any dental office, and it is more likely to be adhered to than a more elaborate arrangement, which may, at times, be allowed to lapse in some important particular.

The preparation of the mouth for surgical interference is overlooked to a great extent. A feeling exists that since it is impossible to render the field sterile, any attempt to do so is useless. Certainly, any reduction in the surface bacteria is to be desired; and, often, much can be accomplished by cleaning the teeth and otherwise putting the mouth in fair condition before surgical operation. Certainly, every effort should be made to render the point for hypodermic injection as sterile as possible before needle insertion. The efficacy of iodin and other irritating antiseptics for this purpose is open to question.

The instruments used, and the means of sterilization employed for local anesthesia generally, have never appeared satisfactory to me. The all-glass Luer syringes, thoroughly boiled, and needles,

*Read before the Chicago Dental Society, Dec. 17, 1929.

boiled before each insertion into the tissue, are essential, in my opinion, for an acceptable technic.

The actual technical procedures in the extraction of teeth are relatively unimportant, but the fundamental principles underlying such procedures should be thoroughly understood. One operator may accomplish with forceps the same task for which another will prefer an elevator, and if the task is successfully accomplished, neither is to be criticized for the technic employed. But if the one operator lacerates the soft tissue with the forceps, or the other fractures the alveolar process with the elevator, severe criticism is in order.

The opinions that I am expressing are derived not so much from my own operative experience as from my observation of several hundred dentists as they operated in the postgraduate clinic at Northwestern University Dental School. These men represent a cross-section of the profession of the country probably above the average, and I believe my observations there have given me a fair insight into what a patient may expect when he visits a dentist, an average dentist, for the extraction of a tooth.

My observation is that a fair amount of technical skill in extraction has been developed by the majority of dentists. Technical skill combined with sound surgical judgment is not met with so frequently, and it is the difficult or unusual case which especially requires the presence of both these qualities. A skilful technic for a routine task is easily acquired, and there is no excuse for its absence in the extraction of teeth.

Two general criticisms of the extracting technic of the majority of dentists may be made. The first is that, frequently, the task is made more difficult by awkward body and finger positions. Accurate visibility of the field is often obscured by the body blocking out the light or by failure to use the left hand successfully in retracting surrounding structures.

While the tactile sense can be developed to become a valuable adjunct, it should not replace constant, careful visual observation. The other criticism that I venture to suggest is in regard to the speed of operating. Most operators work too rapidly, applying increased force with increased speed, and thereby losing a measure of control over the force applied. Consequently, more accidents occur.

I have observed three different mental attitudes toward the extraction of teeth. One group apparently has in mind only the fact that the tooth must be removed, disregarding the possible injury to the surrounding structures, and many and serious are the injuries caused by this type of operation. Another group proceeds to the removal of a tooth in the most elaborate manner possible, making a major operation of a minor one, with no commensurate benefit to the patient. The others, and fortunately they are increasing in number, plan and execute the removal of the tooth in the most expeditious manner possible, but never at the expense of unnecessary trauma of supporting tissue.

In preparing to extract a tooth as in any operative procedure or plan of treatment for a patient, the first and most important requirement is an accurate diagnosis of conditions. We must make a careful diagnosis of the condition of the tooth and the surrounding tissues, and give especial attention to the general condition of the patient.

It is not my province in this paper to consider the diagnostic points in determining whether or not to extract the tooth. A consideration of the patient's general

physical condition is imperative from the point of view of the reaction to the operation, as well as in the selection of the anesthetic. Frequently, difficult tedious operations, such as the extraction of impacted teeth, are attempted for individuals whose nervous mechanism at the time is quite incapable of sustaining this shock, without unpleasant reactions, which may do a greater injury than the retention of the tooth.

Often, patients who are ill are subjected to the extraction of teeth without consultation with the medical adviser, and irreparable injury results. A known diabetic should not be operated on except with the consent of, and if necessary with the cooperative preparatory treatment by, his physician.

In anemia, leukemia and hemolytic jaundice, operative procedures should be considered and the advice of the physician obtained before proceeding, because of the danger of serious postoperative hemorrhage. In cardiovascular disease, some knowledge of the patient's actual condition is imperative, and frequently the physician's advice is essential to safe handling of the case.

We frequently hear the plea that the dentist must become more familiar with physical diagnosis, and I thoroughly agree that this is desirable. I cannot believe that the dentist should make a physical examination of his patient with accompanying laboratory tests and base his procedures on the findings. Such a diagnosis would be most superficial and incomplete and might lead to a false sense of security.

A few thoughtfully selected questions and careful observation of the patient are usually sufficient to determine whether or not further information as to the general physical condition of the patient is necessary. When it is deemed advisable, contact with the physician should be established, or the patient should be referred for physical examination before proceeding.

It is not the province of the dentist to diagnose the general ills of the patient or to advise regarding the treatment of disease which lies outside his field. It should be his ambition to so educate himself in medical science that he has a clear understanding of a physician's report, and he should be competent to enter into an intelligent discussion with the physician regarding the relationship between the physical findings and the dental problem.

The physician will welcome a closer liason with the dentist who is intelligently cooperative, but will give little deference to him who plunges outside his field to exploit his unassimilated knowledge.

The recent tendency to attempt the cure of dental ills by regulation of diet is a case in point, and I fear we shall become the laughing stock of the medical profession unless a more cautious approach to this problem is conceived. There is a danger that dentists will attempt to regulate the diet for correction of dental ills, disregarding such serious and important conditions as gastric ulcer, hypertension and kidney disease.

The extraction of teeth involved in an acute infective process, or for a patient with an active superficial mouth or throat infection, should never be undertaken without a most careful study of the entire situation. Even the presence of a low-grade infection about the gum of a partially erupted tooth often contraindicates immediate surgical interference.

Finally, before extraction, a diagnosis of the immediate structural condition of the tooth and surrounding bone is made, with a careful evaluation of all possible difficulties to be encountered during the operation. Among these factors, one considers the general shape and structure of

the teeth and jaws, and the possibility of a weakened tooth structure, due to caries, or mechanical loss, such as from enlargement of canals to receive pins; and the presence of a possibly brittle, easily fractured tooth, due to long retention without a pulpal blood supply.

The roentgenogram should be employed to depict pathologic conditions such as hypercementosis and condensing osteitis, and normal conditions such as the shape and curvature of roots. Frequently, a preoperative roentgenogram is important as a means of legal protection to the operator, and the employment of such a roentgenogram should not be neglected where it can possibly be obtained.

Another factor which is noted by the observing operator is the change in bone and peridental membrane which is frequently a response to physiologic function. These are especially noted in severe abrasion, or other unusual functional activities.

The constant holding of a pipe in certain positions will cause the development of a more dense compact bone and thinner, more firmly attached peridental membrane in the areas most subject to this unnatural stress.

A careful diagnosis having been made and a study of local structural conditions by observation and roentgenographic findings being completed, the extraction of a tooth should be accomplished easily, following a predetermined technic.

As the technical procedure is carried out, we will frequently discover that our evaluation of all factors was not accurate, and the application of reasonable force by instrumentation in the predetermined manner does not accomplish what was expected. We then may choose one of two courses: we may increase the force applied, or we may attempt to discover the resistance which has been met, and relieve it. If pressure is increased, ultimately something will give away, but we cannot always control the situation, and the tooth may break or the alveolar process may be fractured. While neither of these eventualities are serious, they are much better avoided.

Where the tooth cannot be delivered because of enlarged root ends or diverging roots, it is always preferable to correct the difficulty before proceeding. Two methods are available: to cut into sections the object to be delivered, or to enlarge the opening through which delivery is to be accomplished. Both are properly applied in selected cases in the extraction of teeth.

The armamentarium necessary in the extraction of teeth is not extensive. The customary forceps equipment varies anywhere from two to twenty-eight pairs. Somewhere between these extremes is a happy medium. We have been consistently reducing the number of forceps employed, with the idea of standardization in teaching. We believe five forceps may suffice, and that eight are all that are ever required. We employ the cowhorn forceps for lower molars and root forceps for all other lower teeth. In the upper jaw, we use a straight forceps for upper anterior teeth and the universal bayonet type of varying sizes for all other upper teeth.

Elevators are essential occasionally in extraction, but a large selection of elevators tends to confusion, with little benefit. Those usually selected are too large, and the force applied with them is too great for efficiency and safety. With smaller instruments, the leverage is applied more delicately and more accurately, trauma of surrounding tissue is much reduced, and the danger of applying excessive force is decreased.

The use of an elevator before application of the forceps has its value under

certain conditions, but the universal employment of this method will frequently produce unnecessary trauma, without compensating advantages.

Neither is the elevator always the instrument of choice when the tooth breaks under the forceps. The procedure to be followed in continuing the operation should be considered in relation to the resistance encountered. Each case is an individual problem; the solution depends on the particular situation at hand, and all factors should be considered. Immediate reapplication of the forceps or the unconsidered use of the elevator are conducive to unnecessary trauma.

When difficulties are encountered, the cause should always be established before proceeding. There may be a divergence of the roots, and it is usually preferable to separate the roots and remove them individually. This can sometimes be done with the chisel and mallet, but is usually accomplished more accurately and safely with the revolving drill or bur. After separation, the removal of the roots is usually a simple problem.

When the cause of the difficulty is hypercementosis, excessive curvature of roots or extreme denseness of surrounding bone structure, it is often necessary to remove some bone to accomplish the delivery of the tooth. For this purpose, the drill, the chisel and the rongeur forceps are available. All cause some trauma, and to each there is some objection.

The drill or bur is efficient in selected cases, but there is an objection in the possible injury to the bone by frictional heat. This can be partially avoided by the careful operator. The sharp chisel probably leaves the cleanest cut with the least injury, but its use requires a greater sacrifice of contiguous bone, and the element of shock from the mallet blow is sometimes considerable.

The rongeur is awkward to use and, in general, has little value except in removing prominent edges of bone where complete access is available after extraction is finished.

In general, when an excess of bone is present at the site of operation or the labial or buccal alveolar process is quite thin and its loss will not be detrimental to the final result, removal with mallet and chisel is preferable.

When they are so employed, an incision is made and a flap retracted to expose the bone to be removed. The flap should be sufficiently extensive to permit good visibility, and should be so planned as to cause the least possible interference with the blood supply.

The necessary amount of bone is then removed, the root being exposed sufficiently to complete its delivery, and the incision closed with a suture. The incision only is closed, no attempt being made to leave a tightly sutured wound, but one which still has ample drainage.

In the lower molars and bicuspids, it is usually preferable to remove the necessary bone with the drill or bur, confining most of the cutting to the mesial and distal process and avoiding the loss of the thick buccal plate of alveolar bone.

The findings of Schram[1] suggest that the complete removal of the labial or buccal plate of bone is responsible for a considerable difference in the deposition of new bone. While there are many occasions when such removal is indicated, there are many other times when the final desired contour requires the retention of the complete buccal plate.

Under no circumstances are we justified in any laceration of the gum. If access is not sufficient for the necessary

1. Schram, W. R.: Histologic Study of Repair in the Maxillary Bones Following Surgery, J.A.D.A., 16:1987 (Nov.) 1929.

operative procedures without injury to the gum, a suitable incision should be made and a flap of soft tissue laid back, the incision being closed later with a suture. Such incisions should be planned so that the line of closure of the wound is supported by normal bone, the incision never being directly over the section where supporting bone is sacrificed.

The so-called "surgical removal of teeth" or the "open view" operation has, in my opinion, no place in routine practice.

There are occasions when the removal of a portion of the bone is indicated to correct a malformation, either physiologic or pathologic. When a definite advantage can be gained in constructing artificial dentures, this may properly be done, and it is a simple procedure.

In cases in which difficulty is anticipated in the extraction of a tooth or several teeth, it is frequently advisable to remove the necessary bone before extraction to facilitate delivery of the tooth.

The unnecessary sacrifice of the labial or buccal alveolar wall to permit of easier or more complete curettement or removal of the so-called "granuloma" certainly is an unwarranted procedure.

At the present time, there is no satisfactory evidence that the "granuloma" should be removed. It has developed as a protective and not as a destructive tissue, and I consider it meddlesome surgery to invade this area with a curet.

If enucleation is necessary, as in some small cysts, a more conservative method of approach can be planned than the sacrifice of the complete buccal alveolar process.

A question might be raised regarding discontinuing an operation before complete removal of all roots. Are we ever justified in so leaving our operation incomplete?

Ausubel[2] states that roots should not be left unless the patient is informed, and and that one is hardly justified in leaving roots unless the damage that might result from their removal is greater than that probably involved in leaving them.

The important point here lies in deciding when the injury of removal is likely to be greater than that arising from leaving the tooth in place. I have seen many cases in which such injury was much greater from surgical trauma than could have been caused by the retention of the root. It is often a wise operator who knows when to stop.

In the hospital operating room one morning, I overheard a clever young surgeon explaining his case to an older surgeon of international reputation. He had encountered difficulties and left the operation unfinished, and he asked the older man if that was a mistake. The answer was, "Young man, you can always operate again on a live patient, but not on a dead one."

I believe that the cases in which a portion of the tooth is permitted to remain should be very infrequent. If a careful diagnosis has been made, there will seldom be occasion to consider this situation; but the welfare of the patient is of first importance, and occasions will arise in which sound surgical judgment requires that the operation be discontinued.

The patient should be informed of the situation and roentgenographic examination be made at a later date, with possibly an attempt to remove the fragment under more favorable conditions.

Broken root fragments, especially small ones, are not always easily found and removed. I have received the greatest assistance in localizing such bodies from

2. Ausubel, Herman: May Root Remnants Be Left in the Jaws with Impunity? Dent. Cosmos, 69:580 (June) 1927.

roentgenograms taken with a pair of Schimmel needles in the tissue. These needles are inserted in the buccal soft tissue, placed at such angles that they cross just opposite the position where the root is presumed to be. These are left in place until the operation is begun and a definite localizing landmark established in the bone. They are especially valuable in edentulous mouths.

In removing such roots, ample access is required, and a sufficient mucoperiosteal flap is retracted, which permits necessary instrumentation in uncovering and removing the fragment. Such flaps in any operation are retracted with gauze held in the left hand, as being less traumatic than metal retractors. Occasionally, a suture is passed through the flap, and the assistant retracts it by tension on the two ends of the suture locked in a hemostat. Metal retractors are employed only when the tissue must be protected from the revolving drill.

Tight suturing of mouth wounds is seldom if ever indicated. Sufficient sutures should be placed to retain a flap in position and prevent its dislodgment by tongue or cheek movements; but adequate drainage should always be maintained.

The selection of suture material is not particularly important where it serves such a minor purpose, but nonabsorbable material is usually recommended. I prefer fine twisted black silk as being less uncomfortable to the patient, although it is more difficult to manipulate than some other materials.

When an operation is completed, whether it be a simple extraction of a single tooth or a more complicated and extensive operation, the responsibility of the operator is not ended. Proper instruction in postoperative care should be given and suitable arrangements made for observation of the conditions of healing.

Some operators insist that every patient come in for postoperative observation. This is undoubtedly the safe course, although it may not be essential in uncomplicated cases, in which difficulties regarding time and distance render it a hardship for the patient to return for examination. It should be impressed on the patient that any interference with normal uneventful recovery should be reported and given proper attention.

In recent years, the successful employment of a local anesthetic and the more frequent use of the roentgen rays have been important factors in improving the service rendered to the patient in the extraction of teeth.

That there can be and will be a further improvement is certain. The younger generation of dentists is keenly interested in improving themselves by developing their diagnostic and technical ability in the surgical field.

The extraction of teeth cannot be confined to the specialist, under present economic conditions, and there is no reason that the general practitioner should not successfully perform a large percentage of such operations for his patients.

The use of a general anesthetic in the dental office should be abolished, in my opinion, and all patients requiring such service should be hospitalized. This is economically impossible in many cases, but it is desirable and the time is fast approaching when the administration of general anesthetics will be confined to hospitals. From my own observations, I am convinced that the public will be much better off when that time arrives.

The one point which I wish to emphasize is this: In the extraction of teeth, the most important factor throughout the operation is the very careful handling of the surrounding and the sup-

porting tissues, and no operation can be regarded as successful if these structures have received unnecessary trauma.

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PREOPERATIVE AND POSTOPERATIVE INFECTIONS*

By FREDERICK F. MOLT, D.D.S., Chicago, Ill.

THE subject "Preoperative and Postoperative Infections" permits of infinitely more leeway than does the time allowance. I shall therefore confine my attention to the acute infections more commonly met with.

ACUTE ABSCESS

The acute abscess is probably the disturbance most frequently encountered and, unfortunately, most often improperly handled. The acute condition may be an incipient infection due to recent death of the pulp, a sudden flare-up of a tooth long pulpless or putrescent, which may not have given any previous history of disturbance, or an acute exacerbation of a long standing, latent peri-alveolar abscess or cyst. The manifestations of swelling, pain, increased temperature and pulse rate may be identical in all three conditions.

Roentgenographic examination may, in the first two groups, disclose no bone destruction, while the latter, because of previous chronicity, will give evidence of destroyed bony structure.

The most unfortunate misconception regarding this type of infection in the minds of both the laity and many physicians and dentists is that the immediate application of heat is indicated. Quite the contrary is true; for if, in the incipiency of the swelling, an ice bag is kept continuously over the affected part, the abscess formation will be kept to a minimum or, in many cases, entirely aborted. If the infection were localized at its point of origin, we might be spared the necessity of making external incisions for drainage in many cases in which, when first seen, there is no alternative.

We have heard the hot water bottle, the salt bag and the heating pad inveighed against for thirty years, and yet, day after day, when we question patients with swollen jaws requiring external incision, we find that the physician or the dentist or some kind friend has advised the use of a hot water bottle. Let us spread this part of the doctrine wide; it will be worth while to broadcast it: Moist heat in certain cases, yes, but dry heat, never!

Another established misconception is that, under all circumstances, the extraction of an acutely infected tooth should be postponed until all swelling and other symptoms of infection subside. We might consistently add "if and when," for since the extraction of a tooth will frequently provide the most adequate and free drainage, and sometimes the only drainage, there are many cases in which immediate extraction is not only permissible but also imperative. By immediate action, we may abort the abscess and avoid much more serious sequelae.

*Read before the Chicago Dental Society, Dec. 17, 1929.

One point particularly should be stressed: curettement is never to be done in such an acute condition. This is the marked exception to the practice of completing a surgical procedure at the original operation. If the periapical tissue or sac comes away with the tooth, well and good; if not, we must chance the need of a secondary operation for curettage when the acute stage has subsided.

Occasional acute abscess conditions of this nature will originate from deep pyorrhea pockets and, instead of discharging as one would expect, directly through the pocket, will burrow under the periosteum and cause extensive swelling. In any case in which there is a palpable accumulation of pus, the extraction, if indicated, may profitably be accompanied by incision through the overlying mucosa, with the insertion of a drain here, as well as a dressing in the socket. Iodization (3.5 per cent solution) of the infected socket and wound is an aid in the control of infection.

In accordance with the duration of the swelling in these acute abscess cases, the liberated fluid will vary from a serous to almost a caseated pus. On microscopic examination, there will be found, usually, a mixed infection with the staphylococcus predominating.

Drainage of the infected area and extraction of the offending tooth are almost invariably effectual in controlling this type of infection. Swelling and other symptoms will subside and an uneventful recovery follow.

STREPTOCOCCUS INFECTION, SO-CALLED

Acute infections of a much more serious type arise quite frequently and should be differentiated from these previously described. Such infections originate most frequently from teeth that have been pulpless and quiescent for a long time, from teeth in which canal treatment has recently been begun (either those that have been putrescent or that have been devitalized), from the residual areas of infection remaining after extraction, from contaminated wounds from infected mandibular third molar areas and following mandibular block injections with nonsterile needles or solution. The swelling is brawny and boardlike, with no fluctuation; pain is intense; the temperature may be exceedingly high and pulse rate correspondingly rapid. The face will be flushed and the eyes dull. There is a general toxemia; the patient is sick and looks it.

Frequently, an examination of the mouth is impossible because of a trismus which prevents opening the jaws. The sublingual and submaxillary area may be involved in the cellulitis, essentially a Ludwig's angina. The patient, on questioning, will possibly say that one side of the throat is perceptibly swollen, and the floor of the mouth may be hard and indurated.

The utmost caution should be used in undertaking any operative interference in this type of case. Extraction is frequently of little avail and may serve only to exacerbate the existing infection. It must be recognized that a surgical risk exists, because the fact that the infection has developed to such a degree points to an existing lowered resistance. In other words, the lack of fighting power is the cause of the virulence of the infection rather than the result.

Death of the patient is not a remote possibility in such a case, either from general sepsis, edema of the glottis, meningitis or pneumonia. It is well, therefore, to keep in mind that if extraction has been done during the acute manifestations of infection, and death does ensue, by a peculiar type of reasoning the public will

assume that not the infection but the extraction is the cause. The dentist should therefore proceed with caution in the handling of such a case. Just why a general surgeon can operate and lose a borderline case without this same stigma, it is difficult to explain, but the situation does exist.

For the patient's safety as well as the dentist's, therefore, such cases should be hospitalized at once, and when the dentist encounters such conditions following his own work or another's, he should recognize the advantage of taking this step. The patient's medical adviser or a medical consultant should be asked to collaborate in building up the resistance of the patient and combating the infection.

General anesthesia may have to be resorted to in order to open the jaws for examination or necessary incision, but, more frequently than not, there is no possibility of reaching any definite accumulation of pus until later. The immediate and continued use of hot fomentations rather than cold applications is here indicated, as there is no possibility of aborting the infection, and little chance of avoiding an external incision. To proceed at once to localize the infection at some point both accessible and safe to approach for incision is imperative.

A blood picture is always of value both as a diagnostic factor and as a precautionary record. Repeated from time to time through the duration of the case, blood tests will indicate the degree of progress.

At the first signs of localization, an incision may be made, usually under general anesthesia, and a blunt dissection with artery forceps, continued up to the apparent point of origin of the infection, usually in the mandible. Frequently, several pockets of pus will be found which may be drained by pressing the wound apart with the forceps. A drain is inserted and hot fomentations continued until swelling subsides, the temperature falls and drainage ceases.

A diet rich in vitamins C and D will help to combat both the infection and the accompanying acidosis. The bowels should be kept open by enemas and cathartics. The patient is, of course, kept quiet and at rest. Ultraviolet radiation, both general and local, is of apparent value.

In this type of case, the streptococcus is usually the predominating organism; hence, the designation.

The frequency with which serious infections of this type are found to have had their origin in infected opercula or coronal abscess areas surrounding submerged or impacted third molars would suggest the inadvisability of retaining such teeth when discovered, even in cases giving no history of previous soreness or swelling.

OSTEOMYELITIS

Osteomyelitis is not an unusual sequel of such an infection, although it may manifest itself with little or no swelling. This disturbance also may originate from an acute abscess, from a pyorrhea pocket or from deep seated residue of infection. Acute osteomyelitic infection in children may be coincident with or may follow either the acute febrile diseases of childhood or tonsillitis.

In this disease as well, the greatest contributing factor is apparently lowered resistance, since a latent condition of long standing may suddenly light up for no apparent reason.

The area affected is almost invariably in the mandible, infrequently in the maxilla. The onset of the disease is characterized by excruciating pain, increased at night. If swelling occurs, there is extreme tenderness in that area. The patient's temperature may be normal, sub-

normal or exceedingly high. Teeth in the affected area are loosened, and the number of teeth involved may be increased from day to day.

The roentgenogram shows a peculiar grayish radiolucence of the bone in the region involved, with a loss of the normal cancellations.

Surgical interference in osteomyelitis is confined to establishing drainage from the involved area. This may be accomplished by extracting one or more of the loosened teeth or by incision through the mucoperiosteum and chiseling or drilling through the outer bony plate. With this accomplished, a gauze drain is inserted, and the operator marks time until natural processes shall have limited the infection.

Curettage should not be attempted, as it will result only in opening new areas for infection. Irrigation and redressing at intervals of from twenty-four to forty-eight hours, with the patient given complete rest, and a diet rich in milk for calcium, eggs for phosphorus and vitamins C and D, will hasten the limitation of the infectious process.

Necrosis or dissolution of a large part of the mandible may result, and when an involucrum is discernible in the roentgenograms or there is an apparent effort at exfoliation, the sequestrum may be carefully lifted away. There should be no effort to hasten sequestration, whether it be a matter of waiting weeks or even months. In more extensive destruction, the retention of the sequestrum *in situ* may be practically the only means of holding the periosteum in the proper position for regeneration.

After sequestration and the subsidence of acute manifestations and discharge, any necessary surgical procedures to prepare the affected area for restorative work may be carried out without danger of further disturbance.

VINCENT'S INFECTION

Ulceromembranous gingivitis, frequently called "trench mouth," calls for rigorous effort to effect its control. "Vincent's angina" is the name given the throat manifestation of the disease, which frequently results in edema of the glottis. The organisms found in the mouth —Vincent's spirochete and the fusiform bacillus in symbiosis—are identical, but the term "angina" is a misnomer in cases in which only the gingiva is attacked.

The infection is exceedingly communicable and may be imparted by kissing or by the use of table silver, glasses or cups not properly cleansed. Any irritated gingival margin or interdental space may be the portal of entry, although the condition usually manifests itself in a posterior area. Here again, the open operculum of an impacted or submerged third molar is a most favorable breeding place for these micro-organisms, and an acute flare-up usually coincides with a period of reduced vitality.

In an advanced stage, there is a grayish slough covering the gingivitis margin, and the tissues are swollen and turgid, and bleed readily with the removal of the slough. The treatment consists in removing the membranous slough, exposing the ulcers. Frequent oxidation by the use of sodium perborate or hydrogen peroxid, accompanied by local treatment with cauterant and astringent medicaments, will usually arrest the advance of the disease. Many anilin dyes and antiseptic solutions have apparent value and may be used for cleansing.

Arsphenamin, either dry or in glycerin, for topical application, has undoubted effect, but must be worked fairly well down into the gingival pockets. Vastine recommends positive and negative pressure, applied by the use of a rubber cup in the engine handpiece. In extreme con-

ditions, the intravenous injection of arsphenamin is desirable and frequently imperative, but should, of course, only be made by one familiar with both patient and procedure.

Since it is quite probable that, in many cases, an actual scurvy accompanies or contributes to the inception of this disease, attention to the diet, particularly as to the vitamin C content, is well worth while. A half pint of orange juice containing the juice of half a lemon, given twice daily, will care for any existing scurvy.

During the acute stage of ulceromembranous gingivitis, extraction or surgical operation of any kind is decidedly contraindicated. Even after the acute disturbance has passed, surgical work should be done with the utmost caution, and the invasion of the micro-organisms into the deep structures should particularly be guarded against.

DRESSINGS

It has been our procedure for some years past to dress all sockets showing acute infection, as well as all third molar areas that have been open to mouth flora, with a dressing saturated in rivanol, 1:500. In no case in which this has been used has there been any delay in the subsidence of inflammation or any postoperative flare-up.

POSTOPERATIVE INFECTIONS

It is difficult to draw a distinct line of demarcation between the two classes of infection. In many cases seen postoperatively only, infection has undoubtedly been present previous to operative work, so that the condition attributed to the operation is merely a continuation or an exacerbation of a previous condition, and might readily have been the same or worse had no operation been performed. These infections have been covered in previous paragraphs and the treatment has been outlined.

Other situations undoubtedly follow careless or ill-advised methods of operation or lack of aseptic care of instruments or hands. It is impossible to cover the first grouping except in a general way. Every extraction presents essentially a mechanical problem, and present-day methods of extraction have demonstrated that forceps and elevators are in many cases as obsolete as the turnkey. In order to use forceps or elevators, we must first have access to the tooth or the portion of it that is to be removed. How long the dental profession and the laity will countenance laceration of tissue and shattering of process in order to accomplish a difficult extraction that might be done so much more definitely and quickly, with none of these results, by using just the first principles of surgery; how long they will be content to mark time while Nature is trying to patch together the remnants that might so readily have been left in an ideal condition for restoration, no one can say.

A little judgment and a little study of the case will usually enable one to anticipate any possible complication or difficulty and select both the anesthetic and the operative method best suited to accomplish the result—in one case, nitrous-oxid and a twist of the forceps or a turn of the elevator; in another, block anesthesia with an open-view operation to remove brittle pulpless teeth, with complete results and no laceration. In the background, we have always hospitalization and hospital anesthesia. There is only one right way to carry out any surgical procedure and neither the inability of the patient to pay an adequate fee or the desire of the patient for this anesthetic or that anesthetic should influence the

operator to compromise with his good judgment, or make him content with an operation imperfectly performed.

Avoidance of laceration and complete surgical procedure, which not only removes all the tooth but all diseased periapical tissue and all fragments and prominent margins of process, will eliminate postoperative infection almost in its entirety, if the principles of surgical cleanliness have been followed. I have no patience with the contention that surgical asepsis is impossible of accomplishment in oral operations and that therefore no effort in this regard is worth while.

It would seem hardly necessary to accentuate that surgical asepsis extends to syringes, needles and solution for injection as well as to instruments and that the area in which an injection is to be made should be cleansed and disinfected before the insertion of the needle.

DRY SOCKET

Immediate closure of mouth wounds, if possible of accomplishment and not contraindicated by acute infection, will eliminate dry socket to a great degree. The contributing factors to this condition are disintegration of the blood clot and invasion of saliva teeming with micro-organisms. It has not been my experience that block anesthesia tends toward the occurrence of this condition except that, with temporary ischemia, the saliva may flood the wound before a firm clot has formed.

If the wound has been protected from saliva during operation by being isolated with sterile sponges, and if, instead of having the patient rinse the mouth on the completion of operation, a sponge is inserted, to be held in place by biting until coagulation has occurred, dry socket will be in a great measure avoided. The condition of the alveolar structures surrounding teeth long pulpless and the subacute inflammation from recent root-canal treatment are both contributory to this condition, and, in these cases particularly, the use of an oily dressing or of the soluble "socket suppositories" will very likely ward off this aftermath so disturbing to both patient and operator.

If it is known that there is no remaining infected tissue or débris in the socket, curettage to cure "dry socket" is not indicated. An applicator carrying enzymol to all parts of the wound will freshen the surfaces, and the wound may then be filled with an oily analgesic paste, which is renewed at intervals of from twenty-four to forty-eight hours. Internal medication will, of course, help in the control of pain.

MAXILLARY SINUS INFECTIONS

Invasion of the antrum may or may not be of consequence. In the removal of some upper molars, an opening into the antrum is unavoidable because of the anatomic situation, the tooth roots extending definitely into the floor of the sinus. If the antrum is healthy, there will be no exudate; if it has been diseased, there will be a flow of pus at once, or polypi will crowd down into the wound. There is no possible excuse for curetting, packing or even irrigating a healthy antrum provided no tooth fragment or pathologic tissue has been carried into it. Such interference will, more frequently than not, eventuate in a chronic or acute disease of the sinus.

If multiple extractions have been performed in one area, it is usually possible to close the antrum by suturing the flaps. If a single tooth extraction presents no such possibility a superficial gauze dressing or a vulcanite covering with clasps on the adjacent teeth will provide for rapid and uneventful healing. If polypoid

engorgement or pus, or both, are present, the antrum obviously should not be closed or permitted to close until cleared of infection either by the dentist or the rhinologist. In many cases, there should be collaboration by the two.

PERITONSILLAR ABSCESS

Peritonsillar abscess is not an uncommon sequel to the extraction of third molars with infected opercula, when the area is not dressed and kept open. This situation naturally calls for the rhinologist's assistance, since it is out of our field of endeavor. Peritonsillar abscess not infrequently accompanies the other acute reactions following streptococcus infection as previously covered.

EXTREME REACTIONS

Many cases of severe systemic reaction and of death following extensive extraction procedures have caused apprehension on the part of some of the medical profession, leading them to insist that no matter what the case, no more than one or two teeth be extracted at one operation. Undoubtedly, this is logical in extreme or borderline cases, for these would be surgical risks under any circumstances. In the rank and file of cases, this is as uncalled for as would be the removal of one tonsil, the other being left for subsequent operation. McKesson has commented on this inconsistency on the part of the general surgeon, "who may already have removed the uterus and appendix, repaired the perineum and excised a wart on the neck, all at one operation, a procedure one hundred times more dangerous than the extraction of all teeth."

My own conception of these extreme reactions based on observation of many cases is that they are due not to the extent of the operation but to the method of procedure. To leave infected tissue *in situ* is incomplete surgery, but to stir it up with hit or miss curettage that macerates but does not remove, that changes the oxygen tension, provides pabulum with the blood, opens up areas for absorption and seals these bacterial cultures and mediums in the sockets with the blood clot is worse than incomplete. It is not surprising that violent reactions result. Better complete curettage than none at all, but much better none at all than partial removal of an infected tissue mass.

Completed operations performed with judgment, care and all possible aseptic precautions will obviate postoperative infections.

PHASES OF ORTHODONTIA WITH WHICH THE GENERAL PRACTITIONER SHOULD BE FAMILIAR*

By WALTER COOLIDGE CHAPIN, New York City

THE subject, "Phases of Orthodontia with Which the General Practitioner Should Be Familiar," makes its appeal, not because it offers an opportunity to present some new invention or some pet of my own, but because I feel that there is an interest and desire on the part of the general practitioner for more knowledge of the technic and fundamentals of orthodontia. This desire of the general practitioner should be satisfied by the orthodontist rather than by the mechanic of the orthodontic laboratory, who, at present, with his attractive advertisements and his misleading, so-called easy directions, is enticing the general practitioner into detours at the expense of the patient.

There should not be the wide gulf between the methods of practice used by the orthodontist and those used by the general practitioner. But it cannot be otherwise as long as the orthodontist tells us how intricate are his methods of practice of orthodontia and the laboratory mechanic tells us how easy his methods are and how simple his appliances. Surely, the general practitioner will follow the appeal made by the laboratory advertisements in preference to the warning appeal made by the orthodontist. In looking over these advertisements of orthodontic appliances in magazines, I find practically none of the design and type that are in general use by the orthodontist. Contrary to what we might suppose, too, is the fact that these laboratory appliances are generally far more complicated than those of the orthodontists. This, of course, should not be the state of affairs.

It is my ambition, and, I think, the duty of the orthodontist, to present our ideas, methods and appliance technic so clearly and attractively that those advertisements will cease to show and sell obsolete and impractical appliances, said to possess such wonderful tooth-twisting qualities.

Indeed, it is essential that everyone practicing orthodontia should know how to design, make and repair his appliances. I do not mean that he, personally, should make all of his own appliances, but that he should have the skill for making them if necessary. To this, most of us will agree; yet how often have we all heard of the man who bought an orthodontic appliance from a laboratory, inserted it in the mouth of a patient and expected it to do all the work. As the perfect appliance has not yet been invented, it is necessary for the operator to know how to alter and repair the appliance which he uses. This is not hard to learn when there is genuine interest and a will.

The subject of how much orthodontic work a general practitioner should do is debatable, but the subject of how much

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orthodontic practice a general practitioner should know can easily be answered. He should know as much of orthodontia as it is possible for him to learn and he should seek his knowledge from those who are making it their life work. In so doing, he will measure up to the confidence and responsibility invested in him by those who place the care of their most precious possession, their children, in his hands.

Whether a general practitioner should practice orthodontia or not depends partly, I believe, on the locality of his practice. If he practices in a city or suburb where the services of an orthodontist are available, generally speaking, no; but if in the country, where there are no orthodontists, generally speaking, yes. After all, the best way to answer the question is for the dentist to ask himself, "Am I prepared and do the conditions warrant my practicing orthodontia?" Let him weigh these factors, and if the conditions in his locality demand that he practice orthodontia, let him make it his business to know orthodontic practice so that he may successfully meet the needs of his community.

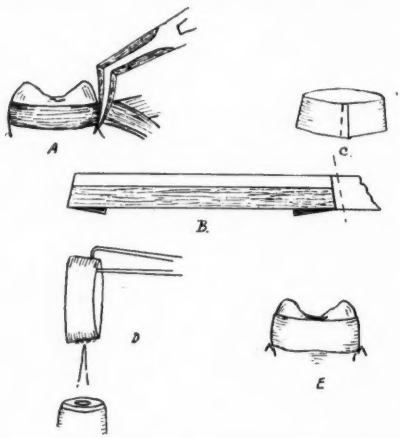

Fig. 1.—Steps in construction of anchor band.

To the city practitioner who is ambitious, we do not say that he cannot or should not practice orthodontia, but we feel that if he does, he should resolve to know enough of orthodontia to do his work as well as the specialist and according to accepted theories of practice and present-day methods. Otherwise, it is an imposition on the patient, who innocently suffers.

Every general practitioner should be well schooled in the following subjects: 1. Normal occlusion and the forces of normal occlusion. 2. Malocclusion; diagnosis and classification. 3. Etiology: general causes, acquired causes, hereditary causes, etc.

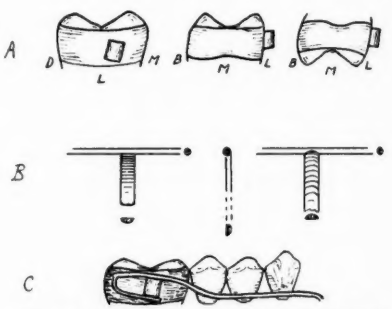

Fig. 2.—Steps in construction of lingual arch appliance.

Every general practitioner intending to practice some orthodontia should also make a special study of the following phases of the specialty: 1. Impressions, models and the use of roentgen rays in orthodontia. 2. Regulating appliances; technic; design. 3. Treatment.

The subject of normal occlusion is not new to us, and I am sure we all appreciate the deep significance of a thorough knowledge of it in the field of orthodon-

tia. The general practitioner should be well acquainted with the forces of occlusion, which are the forces or influences of Nature, operating toward normal development from the inception of a new life until the formation and eruption of the complete dentition. A knowledge of these forces, such as normal cell metabolism, normal muscular and atmospheric pressures and the forces of the incline planes, helps one to understand the causes of malocclusion. Naturally, when one or more of these forces are misdirected or absent, the result is an irregularity or deformity.

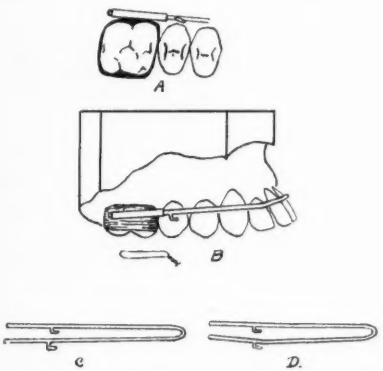

Fig. 3.—Steps in construction of labial arch appliance.

Malocclusion, for the sake of study and treatment, has been variously classified. The value of the recent gnathostatic classification is, I believe, overestimated.

The best known classification is that of Dr. Angle, based upon the relationship of the cusps of the teeth, and the relationship of the teeth and the cranium. This classification will be found simple and most useful to the general practitioner. With this knowledge, he will be enabled to detect developing malocclusion, such as Class II, or posterior occlusion, at an earlier age, and thereby prevent deformities from becoming serious. A common error is often made in diagnosis by classifying as Class II those cases in which the upper posterior teeth have drifted forward. They should, on the contrary, be treated as Class I, or neutroclusion, cases.

The value of knowing the causative factors or etiology of malocclusion is twofold. First, it permits one, in many cases, to foretell and easily diagnose a developing malocclusion and, secondly, it affords the necessary knowledge for eliminating the cause of a particular

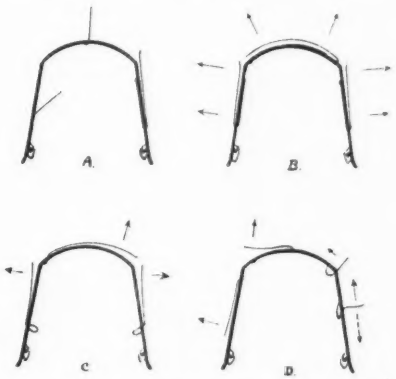

Fig. 4.—Ideal type of lingual arch, and finger spring designs.

irregularity in order that it may be treated successfully. Every dentist should be interested in the former as it permits him to render a most valuable service, really a service that the parents have a right to expect when they place their children in his care. True it is that there seems to be more glory in cutting off a man's leg to save his life than in preventing its becoming diseased in the beginning. But let us have the glory and knowledge within us when, by simple means and the

knowledge, deformities usually lasting through life can be prevented.

Dentists should not forget that in order to assure good occlusion of the permanent teeth, deciduous teeth should not be lost prematurely nor retained too long, and that, when they are decayed, they should be restored to normal form and diameter. To these causes of malocclusion, we must add the early loss of permanent teeth, absence of normal teeth or the presence of supernumerary teeth, bad child habits, sore teeth, mouth breathing, nasal obstructions, abnormal muscular action and such systemic ailments as rickets, diseases associated with high fevers and endocrine disturbances.

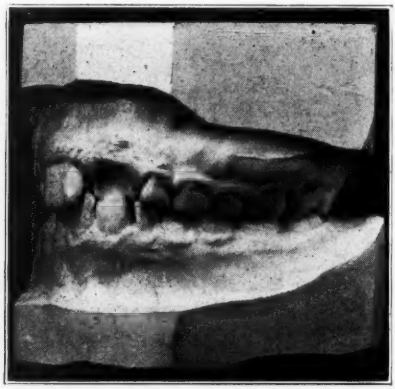

Fig. 5.—Models showing upper left central incisor erupted lingually.

The jaws of the child of 5 or 6 years should begin to exhibit spaces between the anterior deciduous teeth if they are developing properly and sufficiently to accommodate the eruption of the much larger permanent anterior teeth. When this development does not occur, it indicates an arrested or retarded growth of the jaws which, from observation, is usually followed by the eruption of crowded or irregular teeth. Preventive measures are always best. I believe that if all children beginning at the early age of 5 or 6 could be examined and treated by appliances for aiding the development of the jaws when necessary, all serious cases of malocclusion could be prevented. This is not true of those cases caused by mouth breathing. These can be prevented by reasonable care or essential operations.

May I call your attention to the fact that these developmental spaces should occur between the anterior teeth only? The space occupied by the posterior teeth, (i. e., the deciduous cuspid and molars) is the same as that required by their permanent successors, the cuspid and first and second bicuspids. Therefore, they do not require developmental spaces in the deciduous arch.

Another matter of first rank importance and one in which we are all greatly interested is that of the premature loss of deciduous teeth with its resulting malocclusion. Unfortunately, children are not brought to the dentist frequently enough to prevent the ravages of decay from requiring the extraction of these deciduous teeth before their normal time of exfoliation. When these teeth are extracted, it is the serious obligation of the dentist to see that the space of the extracted tooth is maintained until the eruption of the successor tooth.

The space retainer should either be made and inserted by the dentist, or the patient should be referred to the orthodontist for this service. Few occurrences are better attested to than that irregularities will follow when deciduous teeth are lost prematurely. With a little experience, one is able to foretell with considerable accuracy the malocclusion which will result from them. I believe far more cases of malocclusion are caused in this way than in any other way, and

most of them can be treated and prevented, not only by orthodontists but also by dentists.

I have purposely not gone into details regarding the foregoing because it all dwells upon dentistry. In other words, I should like to have all dentists feel that it is not merely orthodontia, but also material in the field of dentistry, and necessary for the practice of dentistry. It is unfortunate that we always associate these subjects with orthodontia and, for this reason, that they are often slighted by dentists. Every dental school which proposes to graduate general practitioners includes this material in the curriculum. Why? Not because it is orthodontia, but because it is essential for the practice of general dentistry.

In orthodontia, it is important that one take good compound or plaster impressions so that accurate models may be produced, models representing the conditions as they actually exist in the mouth. These models should be trimmed in the conventional orthodontic way. Let no one feel that the orthodontist merely trims his models to be "fussy." He does it because of necessity; and surely if it is imperative for the specialist in order that he may know his case better, it is necessary for the general practitioner. I beg of him who embarks in the orthodontic field to have accurate, well-trimmed, original models, and a full set of roentgenograms of every orthodontic case that he starts to treat. The roentgenograms are necessary for a knowledge of the conditions of the roots of erupted teeth, the presence and position of unerupted teeth and other anomalies of the bones which might exist.

The mechanics of orthodontia have been greatly simplified by general adoption and use of platinum alloy metals. These alloys are used for making both the bands and the appliances. There are several methods of making bands and there are, of course, many types of appliances. The bands and appliances which are presented in this paper have been chosen because of their simplicity, their ease of construction and manipulation and their efficiency. The bands described are made with a soldered lap joint. The appliances are of the types known as the plain labial and lingual arches. The steps in the construction of these bands and appliances follow.

Fig. 6.—Same case as Figure 5 (occlusal view); showing design of appliance for treatment.

Figure 1 shows the steps in making a band. The measurement of the circumference of the tooth is taken in the mouth with a soft copper strip. The ends are pinched with the band pinchers as illustrated in Figure 1, *A*. The excess length of the copper strip is cut off with the scissors and each end is folded under exactly at the crease formed by the pinchers. This measurement is placed on the strip of precious metal band material as in Figure 1, *B*, and the exact length marked with a sharp instrument. It is cut about 1 mm. beyond, as shown by the dotted line, in order to allow material for a soldered lap. The band material is then formed into a ring and lapped over exactly to the mark. Soldering flux paste is placed under the lap. While the tweezers hold the lapped ends together, the band is held in the fine gas-blowpipe flame and slightly heated. The tweezers are then placed opposite the lap, as illustrated, and the band soldered by using wire solder or a tiny piece of solder laid on the lap.

The type of tweezers shown is best adapted for grasping the band because most others are liable to spread the lap when the band is heated. After the band is soldered with 18-carat solder, it is tried on the tooth to see that it fits snugly. The band is then trimmed gingivally so as to be slightly under the free margin of the gum and trimmed occlusally to fold slightly over into the occlusal grooves but not so as to be bitten on by the opposing teeth. It is made convex occlusogingivally by contouring pliers, and the band can be further contoured by the small flat nosed pliers. The edges of the band are smoothed and slightly beveled with a 6-inch half-round file and the band is finally burnished and fitted to the anchor tooth, usually a molar.

As soon as the bands are nicely fitted, the tube or wire attachments are soldered to the band by free hand soldering with 14 carat solder. (Fig. 2.)

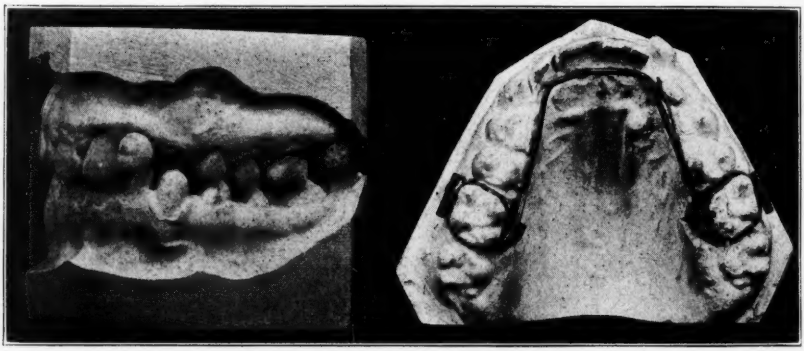

Fig. 7.—Models of lingually erupted cuspid, with appliance for treatment.

The appliances herein presented for your consideration require a half round tube vertically on the lingual surface of the band and a round tube horizontally on the buccal surface. The position and direction of the half round tube is illustrated at *A*, Figure 2. Let it be noticed that it is slightly anterior to the middle of the band and that it tips forward from the vertical. The latter makes for easier insertion of the appliances and eliminates

a sharp bend gingivally in the arch wire just anterior to the tube. On the upper teeth, the half round tube is soldered more gingivally than on the lower teeth in order not to interfere with the occlusion of the lingual cusps of the lower molars.

As soon as the attachments are soldered to the bands, they are inserted on the respective teeth and a full compound impression is taken, which, when filled with plaster or stone, will produce a working model. The bands are now on the plaster or stone teeth of the model and the lingual arch appliance is then made on this model.

marked on the wire and the other post is soldered on in this position. The body wire is made to lie passive in the tubes by heating it to a cherry red in several places anteriorly, and it is held in place with tweezers during this procedure. This appliance is locked in the tube by a small soft gold wire soldered distally of the post, forming the letter "L" as it passes forward under the tube. When this lock wire is bent away from underneath the tube, it unlocks the post so that the appliance can be removed by the operator.

When plain labial arches are indicated, round buccal tubes are soldered on at the

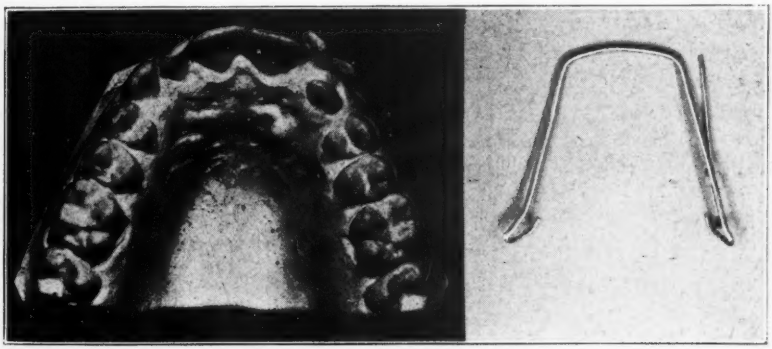

Fig. 8.—Same case as Figure 7 (occlusal view).

The half-round tube receives a half-round post, which is soldered with 18-carat solder to the round arch body wire in the manner illustrated in Figure 2, *B*. The round wire overhangs slightly on the flat surface side of the joint; which brings the body wire close to the band. The post is soldered to the body wire and then inserted in the tube which is on the band on the model. The body wire is bent forward and downward so as to pass around the arch, touching slightly the lingual surfaces of the teeth near the gum line. The location of the opposite post is

same time that the lingual half-round tubes are soldered to the bands. (Fig. 3.) These round tubes should bear the relationship to the bands and teeth in size and direction as is indicated in Figure 3.

Care should be taken to see that the tubes point in the right direction forward and in the same direction on both sides, so that when the labial arch is made to fit these tubes, it will look like illustration *C* and not *D*. This can be tested by inserting straight wires into the tubes and having them meet and cross each

other some distance in front of the teeth.

The labial arch should be formed with the fingers and pliers and made to lie passive within the tubes by applying heat anteriorly. When the arch is finished, it should look like the one illustrated in Figure 3, *B* and *C*. A hook is soldered to the arch wire anteriorly to the tube and its position depends on the requirements of treatment. If the anterior teeth are to be moved posteriorly, the hooks are placed about 2 mm. in front of the tubes to allow the arch to move into the tubes. If the incisors are to be moved forward by ligating, the hooks should be placed posteriorly so as to prevent the arch from slipping through the tubes. This arrangement will hold the arch away from the anterior teeth. If no movement of the incisors is required, the hooks should be placed just against the tubes. These hooks serve to hold the arch in position by ligating the hooks and the tubes together by means of 27-gage ligature wire. This ligature is cut with the scissors to remove the appliance.

In Figure 4, ideal lingual arches and finger springs are pictured. Figure 4, *A*, shows the method of attaching a finger spring to the arch body wire. For this purpose only the very smallest amount of 14-carat solder and heat should be used.

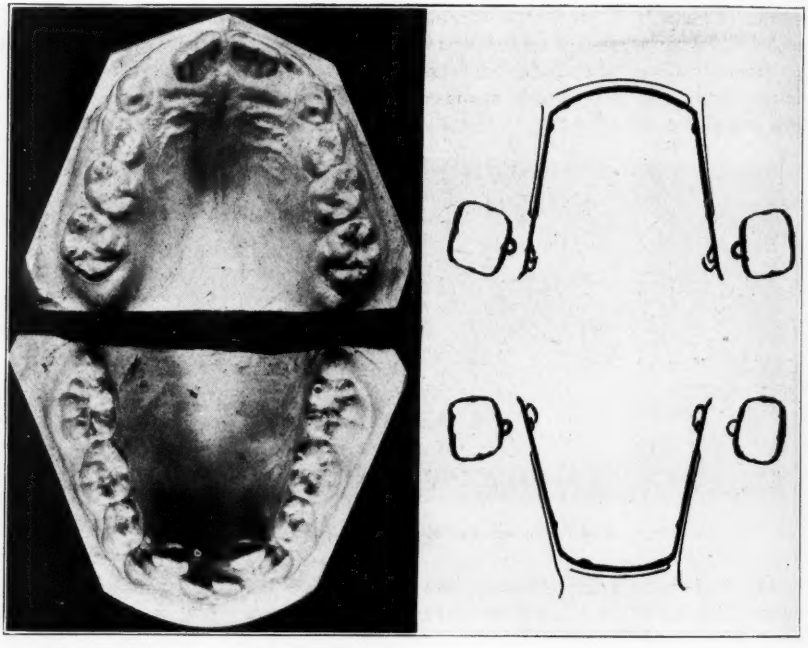

Fig. 9.—Models showing design of appliances for creating general expansion and growth.

The spring wire is joined to the body wire at about a 45 degree angle as shown on the left side of the picture and then bent at right angles to the body wire, forming a tiny loop as illustrated at the

top of the arch. It is then bent back upon itself so that the spring wire runs parallel and gingivally to the body wire.

Figure 4, *B* shows the design of finger springs used for expansion in all directions. These springs are known in the profession as recurved finger or auxiliary springs. The springs are altered for increasing the force by opening the loops at either end. The body wire may be used as a guide in determining the amount of pressure being applied.

Figure 4, *C* displays more types of finger springs. The arrows indicate in what direction force may be applied with these springs.

Figure 4, *D* shows other designs of finger springs, two of which have large loops and are designed for moving the teeth mesially or distally in the line of the arch.

After a careful study of the lingual arches and finger springs just shown, it should not be hard to design an appliance for treating the case pictured in Figure 5. You will notice that the occlusion and development of the arches is fairly good, except that the upper left central incisor as it erupted became locked lingually to the lower incisors. This is a type of malocclusion frequently occurring, and is of great annoyance to the patient and very disfiguring. As it is very susceptible to treatment, it is a shame for any child to grow up with such a handicap. Contrary to what so many operators suppose, the

Fig. 10.—Malocclusion of the deciduous arches, before and after treatment.

bite does not have to be opened during the correction of this case. The bands and the appliance for treating this condition are illustrated in Figure 6, to the right of the model.

Care should be used in starting treatment so as not to apply pressure for about a week after the appliance is inserted. Thereafter, the finger spring may be adjusted to almost the position illustrated, and it will be found in a very few visits several weeks apart that the position of the left central incisor will be labially from the lowers or in a corrected position. Fortunately, there is no problem of retention, as the occlusion with the lowers prevents this tooth from returning to its former position. There is no excuse for children being neglected in these simple cases, no matter where they live. The dentist should either send these cases to an orthodontist or, if one is not available, he should be able to treat them satisfactorily to both the patient and himself in the above described manner.

Figure 7 shows a case in which the upper left cuspid has erupted lingually to the lowers. To the right is illustrated the appliance and finger spring used for its treatment. The working model illustration will aid in making clear the relationship of the parts of the appliance to the teeth and gums. It is not an uncommon thing for people with these conditions to come to us later on in life to have them treated. How much better it would be to have this done when the teeth are erupting, or early in life. This type of malocclusion never corrects itself, and therefore the patient should not be advised to wait and let Nature take care of it. The condition should be treated as soon as apprehended.

Figure 8 shows the model with the appliance removed, giving a more detailed picture of each.

Figure 9 shows a case having a good molar and jaw relationship, but, as in many cases, the arches are crowded because of insufficient room between the cuspids for the eruption of the incisors in good alinement. There are many cases which do not involve extended treatment, such as this, in which the general practitioner can be of real service. To the right of the models are shown the design of appliances for causing general expansion, or development of the arches. Care should be used not to apply too much force at any time with finger springs. One should remember that he is not engaged in simply pushing teeth to new positions, but that he is endeavoring to produce growth within the jaw bones and that

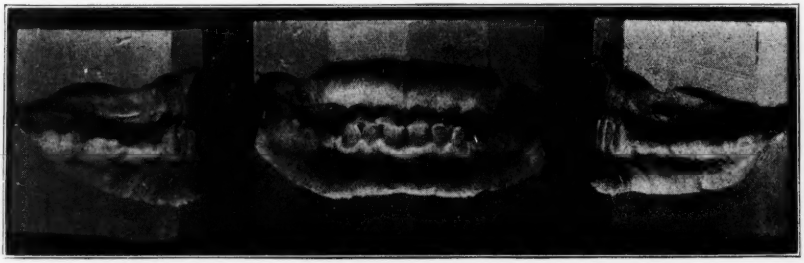

Fig. 11.—Case of malocclusion in which treatment is not indicated at present stage of development.

this is a slow process, requiring patience.

In Figure 10, models are shown to call attention to the fact that malocclusion occurs in the deciduous arches and that there are cases in which treatment should be given at this early age. It will be noticed, on the left, that the upper incisors are in lingual occlusion to the lowers and that a deformity of the upper jaw is being produced because normal development is being prevented. The models on the right side show the beautiful development which has taken place after about three months of treatment. These models demonstrate the developmental spaces which should occur between the anterior deciduous teeth of these upper teeth at this time would have caused them to become loose and probably to be lost. If treated, the upper teeth would be moved, but the growth and change in the bone would not be produced. The condition would not be corrected because the permanent teeth would still erupt lingually from the lowers.

The models in Figure 12 show how imperative it is for the dentist to be on the alert when examining the mouths of children. The dentist in this case had failed to notice the supernumerary tooth on the upper left side, marked *X* in the illustration. This tooth resembled the lateral incisor very closely in form, size

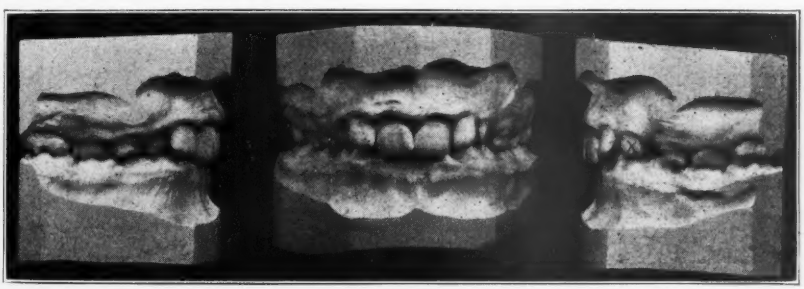

Fig. 12.—Case of overlooked supernumerary tooth.

between the ages of 5 and 7 years. As a matter of fact, in this particular case the permanent teeth have all since erupted in good alinement and in their proper relationships to the lowers.

The models in Figure 11 reveal the fact that treatment should not always be instituted at the time of the patient's first visit. This patient was 7 years old, and from the models, you will observe that the mandibular permanent central incisors were just erupting. The maxillary incisors, at this time, were somewhat loose and the roentgenograms showed their roots to be mostly absorbed. Movement and structure. For treatment, it was promptly extracted so as to allow the cuspid to erupt normally in its place. Generally speaking, supernumerary teeth should be extracted as soon as their presence is known, in order to prevent their causing irregularity of the normal teeth. The roentgen rays are a great aid in these cases.

Figure 13 draws attention to one of the most frequent contributors to malocclusion. The premature loss of deciduous teeth should receive full consideration from the dentist. When, through neglect, deciduous teeth must be

extracted a considerable time before the eruption of the permanent successor teeth, the spaces caused by their extraction should be retained by what are called space retainers or maintainers. These will prevent a drifting into the space by the adjacent teeth, which would occupy room required later by the erupting permanent tooth.

We are all familiar with the fact that teeth generally drift toward and into a space left by an extracted tooth. In fact, by close observation, men have been enabled to lay down rules by which it can be forecast just what drifting will take place. In the illustration is shown a space left by an extracted deciduous cuspid and a space retaining appliance of simple construction suitable for this condition. On the right is a model of another case demonstrating what takes place when the cuspid space is not retained after the premature loss of the deciduous tooth. It can easily be seen how the permanent tooth has been crowded out of the arch and how disfiguring it is.

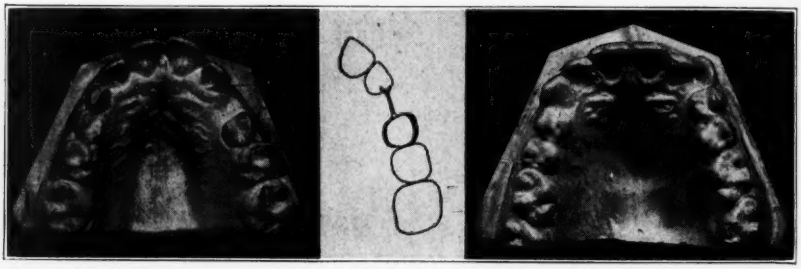

Fig. 13.—Left: Space following extraction with design of space retainer. Right: Model of neglected case.

It seems strange that such a fertile field of endeavor should receive so little attention from the dentists. Space retainers should be made in such a way as not to hold two or more teeth rigidly, but instead should allow one free end to rest on the opposite tooth. These retainers may be made by soldering a retaining wire to a band to span the space and rest on the opposite tooth, as illustrated. It may also be of the removable type, as illustrated in Figure 14. These space retainers were made on these models to illustrate design and construction only. The retaining wire is fastened to the bands by means of the half-round post and tubes similar to the lock of the lingual arch. These removable retainers can be used as active appliances by unlocking the retaining wire and increasing its length when it is desired to move the teeth apart. The public is not yet aware of the benefits of this treatment, but I am sure that parents would greatly appreciate this service and would gladly pay for it.

In keeping with the watch word of today—prevention—let us see that patients have space retainers when indicated. For your convenience, the specifications of the platinum alloy materials used in the above technic are appended:

WIRE

Labial arches	18-gage or 0.040
Regular lingual arches	18-gage or 0.040
Deciduous lingual arches	19-gage or 0.036
Finger springs	23-gage or 0.022
Finger springs	24-gage or 0.020
Lingual locks	23-gage or 0.022

TUBES

Lingual No. 10, half-round, with half-round wire to fit, regular size.

Buccal, 18-gage round tubes, 10 mm. in length.

BAND MATERIALS

For molars and anchor teeth:

0.006 inches or 34-gage thick.
0.017 inches or 5 mm. wide, deciduous molars.
0.020 inches or 6 mm. wide, permanent molars.

For anterior teeth:

0.003 inches or 38-gage thick.
0.017 inches or 5 mm. wide.

GOLD SOLDERS

18-carat for soldering bands together.
18-carat for soldering half-round post to arch wire.
14-carat for soldering finger springs and all other soldering operations.

Wire solder should be about 23-gage.

20 East Fifty-Third Street.

Fig. 14.—Models showing construction of space retainers of removable type.

DENTAL ECONOMICS*

H. B. WASHBURN, D.D.S., St. Paul, Minn.

THE term "economics" as originally used came from the pure Greek and was defined as "the art of household management." The province of economics has expanded until now it takes in "the study of the welfare of the individual, the family or the world." Dental economics, in a broad sense, involves the entire structure and organization of dentistry, its history, the educational methods employed, a clear understanding of what constitutes the work of the dentist, the relation between dentists, an evalua-

*Read before the St. Paul District Dental Society, Dec. 10, 1929.

*The papers of Drs. Washburn, Lasby, Ernst and Hartzell were presented as a symposium.

tion of dental services and fees and standards of living; and, finally, dental economics must take into consideration the process of building up an estate against the inevitable time of decreasing earning power. The four phases selected for presentation as a symposium do not cover the selected subject adequately, but attempt to show that there is a deeper significance in the subject than that of the so-called business side of dentistry.

Our work should be recognized as a vocation not so very different from any other gainful occupations. We may take considerable pleasure in thinking of dentistry as a branch of the healing art and we may feel that, in our efforts to relieve suffering, business principles should be forgotten. But probably few would care to devote their lives to this high calling without the remuneration which comes as compensation for services rendered.

Business is a necessary side of every man's life, no matter what his occupation, and he should conduct his affairs in a methodical manner and pay his way if he is to be counted successful among his fellows. The dentist is called on every day to share business problems of all kinds, and it strikes one rather forcibly that it is only common sense that he should devote considerable thought to business methods within his practice and outside as well.

Just what is there about dentistry that can make one think that good dentistry and sound business principles cannot get along together? Even the dental educator is beginning to ask himself this question. This is a step in the right direction, for we agree that the dental college is the correct place for such study and instruction.

We still have a few skeptics among us who view with disfavor any plan that contemplates bringing business into the profession, and such objectors apparently classify business methods as a thing that will interfere with professional ideals or something that will work unfairly for the patient. We should not be interested in unfair methods, and it is our business to search diligently through our professional responsibilities for signs of unfairness not only to the patient but also to the dentist and his family. If the ideas of the essayists who participate in this symposium mean anything they mean that good dental service and correct business principles are inseparable. Neither is entirely successful without the other.

ORGANIZATION AND MANAGEMENT OF THE DENTAL OFFICE

The dental profession was taken by surprise twenty years ago when George Wood Clapp began writing his stories in the *Dental Digest* under the title "Letters from Brother Bill," in which he gives concrete suggestions to his friend Harry for improving conditions in his practice. Dr. Clapp wrote those stories from information received from dentists located in all parts of the country; and thus they were founded on fact instead of being altogether figments of the imagination, as many thought them to be. We may not agree with the diagnoses and treatment of dental practice ills as set forth by Dr. Clapp, but we must admit that he was the first to make dentists think of the common sense management of their work and the income from that work.

Dentists who are successful and dentists who are not should take careful stock of their respective situations and conditions at definite intervals and, wherever possible, try to stand outside the too-well-known atmosphere of the every-day practice in order to obtain a detached point of view.

The modern football coach finds value in keeping some of his first string players on the sidelines a part of each game that they may get a detached view of the play, a different view from that they would get on the field in action. In any line of human endeavor, it pays to stand at one side occasionally and try to see our work as others see it. In this paper, I shall attempt to point out as from the sidelines some of the things that determine the success or failure of any typical practice.

Drs. Lasby and Hartzell treat in an economic sense the value of dental education and the patient's needs. The graduate in dentistry who has his license to practice the art of caring for the patient's needs is in the same position as any individual who has the education or some special service with which to go before the public. The method of approach to the public is of considerable importance and should not contemplate attracting attention by means of ornate and pretentious surroundings nor by going to the other extremes of downright carelessness.

The plan of getting together what is rightfully needed to begin dental practice properly requires, in addition to a knowledge of the dental art, some common sense business training or, in other words, knowledge of ethical business principles, something the majority of dental graduates do not possess under the present plan of dental education.

Dental educators are searching for ethical ground in the field of business practice in the hope of finding material to include in the dental curriculum. The time is no doubt close at hand when the dean of some dental college will have the courage and foresight to include a chair of dental economics as a regular part of the course. By careful preparation of subject matter and intelligent selection of instructors in the subject, an attractive and valuable course could be presented.

As a concomitant to college instruction in economics, the graduate should, whenever it is possible, associate himself with an established practitioner for an appreciable length of time before beginning practice for himself for the actual knowledge as to how to conduct a dental office. As the situation now obtains, we have practically nothing of either economics in college or beginning practice in another's office, and it is largely up to the dental manufacturer and dealer to guide the graduate. Under the circumstances, they have done a commendable work, and if there are those who object to what has been done, perhaps by greater cooperation there may emerge better plans for equipping the graduate to begin his professional career.

The truly essential characteristic which we wish our graduates to be endowed with is a desire to become first-class dentists; to be able to deliver dental service above reproach. But assuming that he has developed the required technical skill, that his knowledge of the healing art is broad, that he has within him high professional ideals, that he has unbounded enthusiasm for his profession, it seems logical that he should also be grounded sufficiently in sound business principles to be able to manage properly and organize the forces by which he hopes to put his skill in the healing art to work.

Every dental practitioner who thinks back to the time of equipping his first office remembers how little knowledge there was available to assist him in determining what might constitute the essentials and then to systematize the whole on the best working basis.

One of the first economic questions that should be definitely investigated is

that of equipment for the beginner. How far need he go to present a satisfactory appearance to his patients? How much is he retarded those first years by what is termed necessary overhead? What is the effect on his later life of finding it easy in the beginning to assume a serious obligation in the way of deferred payments on an outfit that is beyond his capital on hand? How much better would his position be if he started out with an oufit within his means and, in addition, had a cash reserve?

Real research on these questions and many more like them will produce evidence more valuable than the opinions that we have today. Record and accounting systems are a vital part of a well-organized dental office, but should be neither expensive nor complicated. Patent systems are good principally for the instruction that goes with each, but are unnecessarily expensive in first cost and replacement of parts. The chief value of any record system comes from knowing just what it will accomplish in the office. The dentist who has worked out a system of his own is in the best position, not because his plan is best but rather because he has actually studied out what he needs a bookkeeping system for. In such cases, the dentist usually comes to the conclusion that a simple and inexpensive card or book are sufficient. Many men conscientiously make entries in their books every day and yet cannot give the answers to the questions that any simple plan should give.

A good way to judge a bookkeeping system is to make out a list of questions that one should know the answers to and see how easily the information can be obtained. Again, emphasis should be placed on the need for knowing why keeping records and books is of value in the dental office and when the dentist does understand that, fundamental selection of a system will be simplified and the results will be satisfactory. Organization of the various factors which go to make up an efficient dental office must include consideration of the assistant. There may be reasons for dispensing with the services of an assistant when entering practice, but if that decision is founded on economy, it would seem to be good sense to rearrange the budget so as to make it possible to include an assistant.

Definite rules are helpful in any plan to determine the qualifications of applicants for the position of dental assistant. In order to formulate such rules, the dentist must inform himself as to what he will be demanding of a girl in his particular office. It is an unwise plan merely to employ a girl for no particular reason, blindly hoping that she may work into the office routine and perhaps accomplish some good. One dentist may want a girl only for the purpose of keeping his office clean and to answer the telephone. Another may demand efficient assistance at the chair and in the laboratory, while, in another office, there may be a place for a strictly business type, trained in accounting and stenography.

It is not only important that intelligence be used in the selection of a girl but there must also be a great deal of patient and intelligent direction on the part of the dentist to so train the assistant that she may perform her duties with the same discrimination and judgment that the dentist is trained to exercise in his work. Patients appreciate the fine teamwork exemplified by a competent dentist and his thoroughly trained assistant. The dentist may profit if he, from time to time, takes stock of himself. Personality is largely a matter of being healthy, clean and happy. No one likes to be around an unhealthy, unclean or

unhappy person, and of course there are several degrees of any or all of these conditions.

Self-inspection may reveal a tendency to argue with patients, and surely there could not be a more unwise or unnecessary thing to do. If we must talk to patients, it might be better to say things that will instruct the patient about his mouth. Ponderous discussions are not needed, nor going into tooth matters too scientifically. But every dentist should be fairly bubbling over with enthusiasm for dentistry, and he should get some of that feeling over to the patient. The patient who senses genuine feeling on the part of the dentist for taking a special interest in his case as though it is the most important in the world gains a confidence at the outset too valuable for words to express.

An entire paper could be written about cleanliness in the dental office. If one cares to select just one point about office management in an effort to find the one most important, he could easily and truthfully choose cleanliness. Fastidious and scrupulous cleanliness is noticed by the patient, and while he may not mention it, that may be the attraction that brings him back. Some men do not have this sense of being clean either in their own person or in their surroundings, and when this unfortunate situation arises, such men should engage someone who has the right ideas to guide him.

Keeping appointments promptly is a matter that comes under the head of office management. Many of the worst offenders are among our best operators. It is agreed that the patient in the chair deserves our undivided attention until we have accomplished the thing that we set out to do and in the best manner that we are capable of. But if a plan for management means anything, surely it means that the dental operator should early in practice learn to systematize technical procedure in an effort to be fairly certain as to how much time any given operation will take. There should also be an effort to so manage things as to eliminate nearly all interruption, such as the use of the telephone and stopping to talk to well-meaning friends or salesmen. If we remember that the patient in the chair has made some effort to come on time and is not altogether happy, and further that he expects undivided attention during the time of his appointment, we may be strengthened in our determination to eliminate interruptions of all kinds.

During the time the young dentist is building a practice, it is well for him to remember that his education was not complete when he graduated from dental college. He should carry out plans for developing his technical knowledge and skill as much as possible each year. In dental societies, those who are entrusted with the job of formulating the programs for our meetings are faced too many times with the proposition of having those approached say that they cannot accept because they have nothing in the form of a clinic or a paper to present. Never do dentists in such a predicament seem to realize how they are cheating themselves, for there is no better way to improve our knowledge of dentistry or skill in operating than by writing a paper or developing a technic clinic. This should be done constantly by every dentist whether or not he is ever called on to present the results at a meeting.

As time goes on and the practice grows in volume and becomes better as to the type of patient, and the income warrants enjoyment of the kind that appeals to

the dentist, there comes the time that we may call the most critical in his career: When the dentist begins to think that he has "arrived," it is a tendency of human nature in such a position to let down in the many rigid ways of self-discipline that he has built up. Little things so often wreck what seems to the dentist to be a smoothly working machine; for example, becoming careless about keeping appointments promptly, slighting an operation now and then, being less courteous than usual, careless in keeping the office clean, stealing away for an extra game of golf which may actually mean neglect of important matters in the office.

Then there is that all-American game of "keeping up with the Joneses" and a resultant lack of concentration on office affairs. Worth while contacts outside the office may be neglected. The most insidious influence that creeps in during this phase of the successful dentist's life has to do with a gradual and unnoticed tendency to think less and less about dentistry—what really amounts to a lack of the old enthusiasm for dentistry which had so much to do with the success up to the time we are discussing. Rather than have all of these detrimental things creep into a successful practice, the dentist should guard against having that occur and should become more and more alert to the needs of a modern dental office, and more enthusiastic about his profession. A great economic need in dentistry is to formulate plans early in practice to build carefully and solidly and stick steadfastly to the plan not only in the building years but also in the years when it seems the building process is finished.

It is not the volume of work we do, but the kind we do that counts. Results obtained when the work is through are what figure in the final accounts. Without some regular system and plan, much of our labor is in vain; a worker may not be a lazy man, yet small his progress and gain.

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DENTAL EDUCATION*

By W. F. LASBY, B.S., D.D.S., F.A.C.D., Minneapolis, Minn.

THE subject of dental economics is being freely discussed by members of the profession and others interested in dental problems. The programs of dental meetings and many magazine articles indicate a widespread interest in the subject. It was to be expected that the rapid social, intellectual and commercial changes of recent years would make their influence felt in professional activities, and dentistry, like the others, would undergo a period of rapid change and adjustment.

To practice the methods some of us were taught to use in our college days, and to use the equipment which at the time was the "latest and best," would bring to our mind in a forceful manner the progress of the past few years. I am optimistic enough to believe that there are greater possibilities in the future.

*Read before the St. Paul District Dental Society, Dec. 10, 1929.

To me, the study of dental economics is an attempt on the part of the dentists to understand the rapidly changing events in the business world and to adjust themselves to the new economic order of events. In professional matters, the judgment and ability of the average dentist ranks high, but, as a group, their ability in business matters and their credit ratings are not all that we should desire.

The ideal dentist is that fortunate individual who combines professional service and business methods in the conduct of his office. Professional success involves financial success. We should remind ourselves that permanent success in building up and maintaining a dental practice takes into consideration the welfare of both parties to every transaction. The patient's welfare as well as that of the dentist is fundamental. With a pencil and paper, we can figure out what we think is a satisfactory return for the service rendered, but unless the patient leaves the office satisfied both with the financial arrangement and the professional service, a practice cannot be maintained on a permanent footing.

To a prospective student, I would say: Dentistry offers satisfying returns to those who pay the price to attain the object in view, which is, first, a good education in dentistry, then, the building up and maintaining of a successful practice. It offers the great privilege of human usefulness, a reasonable income and, in these days of large combinations, the unusual opportunity of independent, individualistic attainment, and, finally, it brings those unmeasurable compensations which come to a professional man from those he serves and which make our efforts worth while.

Who should study dentistry; what should be taught in college, and how long is it necessary to make the course of study? In 1840, the Baltimore College of Dentistry was opened. The course offered consisted of two school years of four months each for graduation. As knowledge has increased in all departments of human activity, the scope of dentistry has been extended. Primitive dentistry was empiric, and its practice a mechanical art. Developments in the sciences of bacteriology, histology and pathology, with their combined scientific knowledge, have made of dentistry a health service. The general practice of dentistry is now based on a combined training in medical sciences and dental technology.

To teach a student this great fund of scientific knowledge and to develop in him the technical skill and judgment required to perform the usual dental operations in the oral cavity is a difficult task for any dental faculty to accomplish in the time alloted for the course. Thirty years ago, the completion of the eighth grade in the public schools was all that was required for preprofessional work. Step by step, the requirements have been advanced until, at the present time, four years of high school work are followed by a five-year course as the minimum time to prepare for the beginning of a practice.

To further increase the educational requirements either in the preprofessional or in the dental course itself does not seem advisable. The present requirements should be sufficient when viewed from the standpoint of the time required and the expense involved. If the course is further extended, a student at graduation will be older, and his financial obligation for his education will be increased, bringing worries and embarrassment in the beginning of his professional career. Subsequently, there will be delay in his marrying and establishing a home for

himself and family, and a tendency to decrease the number of years of productive professional life. Thus, the cost of dental service to the public will increase. To lengthen the course from five years to six after high school does not seem to be justified at this time, although fifteen schools in the United States and the five schools in Canada have done so in order to include in their curriculum courses which they feel are necessary to prepare students properly for the practice of dentistry.

The type of student admitted has much to do with the length of time required to complete the course. Those who have completed two years or more of preprofessional work, with an aptitude for the sciences of biology, chemistry, and physics, combined with a fair degree of mechanical ability, are the most desirable. If we could have a "job analysis" of the present situation in dentistry and its requirements, the question of vocational guidance of students preparing for the study of dentistry would be simplified. We have recently learned that one of the great educational foundations is about to undertake such an analysis of our needs.

Already, there is a serious question raised among those concerned in dental education as to whether we should expect all students to complete the full required course of study, or should educate them to varying levels to perform some of the specialized service required of a dental office. We have an increase in the number of dental hygienists, and a decided increase in the number of dental mechanics or technicians throughout the country who are doing a great deal of work formerly done by the dentists themselves, and, in some states, they are making decided progress toward the time when they will be able to take over the chair work in prosthetic dentistry and crowns and bridgework. Let us hope that the latter situation will not develop, as unquestionably it will affect the status of dentistry as a profession.

It is my opinion that dentistry, which has evolved during the past ninety years as a natural and distinct health service, can best serve mankind by continuing as a separate profession, closely affiliated with medicine, but with its own educational activities, professional practice and statutory regulations.

Not many years ago, the majority of dental schools throughout the United States were of the privately owned, proprietary, profit-taking type, organized and conducted by their owners to stimulate the interest of dentistry and assist in its progress; but frequently their motives were influenced by the amount of profit they received from their institution.

Fortunately, that period of dental education has passed. No schools of that type are now in existence, and all of the thirty-eight schools in the United States and the five in Canada are either departments of or affiliated with the state universities, or privately endowed institutions, and student fees and infirmary income pay only a part of the expense of conducting the school. Quite a number of the schools now in existence would be greatly benefited by more adequate support from the institution with which they are connected or by endowments built up from private gifts. Dental education has not received in the past so many gifts as medicine nor so many as might have been expected. In recent years, several schools have received rather large amounts, and several large gifts have recently been given to establish dental clinics. This is indicative of the increased value which the laity are placing on the service that the profession is rendering.

To keep the cost of dental education as low as possible to the students, and to have colleges of dentistry made attractive because they are well equipped, richly endowed or state supported, will tend to bring into our ranks the most desirable men, men who will improve the work of the profession.

Someone is likely to say, "If you make the expense reasonable and the surroundings pleasant, too many will study dentistry and there will not be enough work for them to do after graduation; and then what will happen?" One thing is certain: the need of dental service is increasing rather than decreasing. A statistician can easily show that there is a tremendous amount of dental service needed by the public which they do not seek. Unquestionably, the service which they need, if properly rendered, would contribute an inestimable value to their health, comfort and welfare, and most of them are able to pay for such adequate service if they need it. The fact remains that, at the present time, many of them purchase the luxuries contributing to better living conditions, such as automobiles, radios, etc., and neglect dentistry.

We as dentists have a settled conviction and point of view that dental service is more necessary to the health and happiness of the public than the luxuries which they choose to purchase, but the fact remains that they will have their own way in these matters, and we must educate them to the need of the service which we are able to render them. We ought to remind ourselves that dentistry serves the public, rather than that the public serves dentistry, and when the public opinion of the value of dental service is developed to our point of view, there will be more dental service requested than the present number of dentists can supply.

The most frequent question asked about dental education is, "Why don't you teach the students more about the business side of dentistry so that they will know how to run their offices when they get out of school?" I have already indicated to you some of the difficulties encountered in trying to crowd into the three years of professional work the courses required in the fundamental sciences and the technic and clinical courses in dentistry, and also the fact that the five-year course after high school should not be lengthened because of economic and social reasons.

The dental student devotes 38 per cent of the time of the entire course to clinical work in the infirmary, which is managed as nearly as possible like an efficient office. The staff of nurses, assistants and faculty train the students in meeting patients, making a diagnosis of the work needed, talking it over with the patient and arranging for the cost of the work and appointments. At all times, the students are held responsible for making and keeping appointments, and making proper records and collections for work done.

Faculty advisors to these students are all men in successful practice with a background of experience. A lecture and conference course covers the subjects of ethics, office equipment, office management and allied topics pertinent to the conduct of a dental practice, but the student lacks the background of experience, which can be obtained only by operating an office of his own. We can teach a student all there is to know about the filling of a tooth with a gold foil filling, but until he does the operation himself, he does not learn how to do it. Likewise, we can teach the student all about the business side of dentistry, but until he gets into his own office and tries to manage it, he does not grasp what it really

means. The school of business administration requires four years to teach its students the fundamentals of business, and, after graduation, they begin usually at the end of the line in some large organization, and by years of work and experience, if successful, will reach the position of head of a department or vice president of the company. It is beyond the scope of the college to meet completely the situation which confronts the recent graduate. He needs professional advice in many cases, and he needs assistance in the business management of his office. To follow the trend in business, the recent graduate will have to associate himself with men of experience and depend on them for advice and help, until, by years of experience, he acquires proficiency in building up and maintaining a successful practice.

MANAGEMENT OF THE DENTIST'S INCOME*

By MAX E. ERNST, D.D.S., St. Paul, Minn.

AFTER the necessary costs relative to conducting the dental practice have been met, the amount remaining is the net income, and it is this income with which this paper will attempt to deal. The amount of this income will depend not only on the money received for the dentist's services, but very largely on the ratio of his office expense to his receipts. The less the overhead, the greater the net income.

This income is the result of our daily toil and represents hours of close and strenuous application. With most of us, it is the only source of income, and it should be guarded carefully so that we and the members of our families may obtain its utmost value. It must provide funds to pay the living costs of the family, funds to meet emergencies and funds to give us the comforts of life after the days of active practice are over. Whether or not it will provide for these contingencies will depend largely on how it is managed.

There are, of course, problems that must be met in the management of an income. Careful planning will be a great help in meeting these problems successfully. Providing the necessaries of life must be our first aim. Expenses for this purpose should be fairly readily met by the dentist of several years' practice, provided these expenses are kept within reasonable bounds. It will be well for the dentist to recognize the difference between necessities and luxuries in this regard and to remember that a necessity for a person of a certain station in life may be a luxury for some one else.

We should hardly expect to base our standard of living upon that of persons whose incomes are much greater than ours. It is impossible for a person with a $5,000 income to live on a scale that would be permitted by a $10,000 income. There is a tendency on the part of many of us to live on the same scale as our

*Read before the St. Paul District Dental Society, Dec. 10, 1929.

friends and acquaintances. If this can be done and we still can keep well within our incomes, no harm will result. If, as is often the case, we emulate those whose incomes are much greater than ours, we are faced with disappointment, discouragement and financial embarrassment. We shall be wise if, early in life, we decide to spend our incomes carefully and to keep expenditures within reasonable bounds.

I am well aware of the fact that a dentist should enjoy a standard of living commensurate with his standing in the community; but many dentists tend to place this standard somewhat above what their income really warrants. While we may become discouraged and dissatisfied when we compare our income with that of the successful business man, we should not lose sight of the fact that for every successful business man, there are many failures; while, as a class, dentists would be held to be fairly successful. It is possible for the average dentist not only to llve reasonably well but also to save from his income, during the years of active practice, an amount sufficient to provide the comforts of life during his declining years. In order to accomplish this, a certain amount of planning is necessary. It will be necessary to make these plans and to put them into effect before he has reached too great an age. The years during which the dentist is able to carry on his practice, at his maximum capacity, are comparatively few, and in order to provide for the later, nonproductive years, he should put his plans into effect quite early in his practice.

C. E. Lawrence, of Enid, Okla., in a lecture before the Minnesota State Dental Association last winter, stated that the average dentist is at the height of his professional career, from the financial standpoint, between the fiftieth and fifty-fifth years of age. From that age on, his income will be very likely to decrease, rather than increase. In comparing the professional lives of lawyer, physician and dentist, he finds that the dentist is at a disadvantage when compared to the members of other professions. The lawyer and physician will, very probably, enjoy a successful practice over a longer period of years than will the dentist. Physical infirmities, which may not affect the lawyer and physician to a serious extent, may be a severe handicap to the dentist. The conscientious practice of dentistry is a strenuous occupation. Good health and physical stamina are required in order that the dentist may render the best service to his patients. We can readily see, then, how the practice of dentistry becomes more difficult for the dentist as old age comes on, with its attending infirmities. Knowing that we shall be confronted by this condition later in life, it behooves us to prepare for it when we are best able to do so. We must prepare for these declining years while our earning power is at its highest point.

The only way to provide financial independence for our later years is not only to live within our income, but also to save a certain part of the income. Probably the most practicable way of doing this is to prepare some kind of budget for our income. There must be a definite planning to make the income go round and have a little left over. Probably the most important part of the entire plan is to see that something is left over. Budgeting means proper planning and spending to the best advantage, rather than just spending while the money lasts. It means the correct distribution of the income rather than spending it in a haphazard fashion. It does not mean that we should sacrifice all those things that go to make life interesting and worth while, but it

does mean that there must be some relation between what is spent and what is obtained in return.

The first step toward financial freedom should be to plan to save something, if ever so little, and the next step should be to stick to the plan. Certainly it is worth trying.

Youth is not a time given to thoughts of the future, much less preparing for it, yet the world is filled with old people who have not accumulated anything, who are too feeble to earn anything and who live miserably for their remaining years, in poverty. Old age may continue a long time and we should prepare for it.

Some sort of a fund or estate should be created to provide an income for old age or to provide for those dependent on us if we should become incapacitated during active years. Accumulations for such a fund may, at times, cost quite an effort but, I am sure that the result will well repay the effort.

How may this fund or estate be provided to the best advantage? There are, of course, different plans which may be followed. Any one of them, to be successful, must be regularly carried out, and should be begun before the dentist has attained too great an age. Probably the most satisfactory plan, at least for the person with a moderate income, is provided by the life insurance companies.

I assume that everyone in this audience realizes the need for life insurance for the protection of those dependent on him. A dentist, who, owing to the nature of his calling, can leave his dependents nothing tangible in a business way, and whose income depends entirely on his efforts, must realize that life insurance for his dependents and disability insurance for himself are absolutely necessary. He cannot, in fairness to his family, assume the risk of dying while still young or of becoming incapacitated in the earlier years of his practice when both of these contingencies may so readily be provided for. Life insurance guards against both of these conditions and it also includes, in its provisions, investment possibilities which are probably greater than most people realize.

Life insurance creates an immediate estate for your family and allows you to save for it after creating it. You may buy your estate on the installment plan. This immediate estate can be provided in no other way. It always pays out more than is paid in, and in many instances it offers returns far in excess of any other investment. With its provisions against disability, it provides for a fixed amount every month as long as the insured is incapacitated.

There is only one way by which we can guarantee as much money as we shall need when we need it most. That way is life insurance. It provides a method which counters the two great hazards that threaten us: living too long and dying too soon. A person lives too long, if, when old age arrives, he has failed to provide for himself. He dies too soon if he leaves dependents unprovided for. A holder of an insurance policy, of sufficient amount, knows that his family will be provided for in case of his premature death, and he knows that he will be provided for in his declining years. To the dentist, it should offer peace of mind, contentment and relief from financial worries.

Limited payment and endowment policies include investment provisions which offer as high a return and probably a greater margin of safety than most other investment possibilities.

The proper investment of money requires training and keen judgment, which the dentist, as a rule, does not possess.

Loss of funds invested may cause worry, which would have a tendency to lessen the efficiency of the dentist in his practice. This, in turn, would tend to decrease his income.

The funds invested in life insurance companies are invested by competent, trained persons, according to thoroughly tested standards, and the losses are negligible. The funds are safeguarded by insurance department supervision in all states. The element of safety is probably as great as in other investment and, of course, much greater than in most of them.

Whether the owning of your home is to be considered a good investment is open to a good deal of argument. Figures may be easily shown which would convince us that, from the investment standpoint alone, the owning of a home usually would not be good policy. I think that it can be shown that most successful men are home owners. There must, then, be something of greater value in the owning of a home than purely the return on the investment. Certainly, it is often a comfort to know that there is one place that you may call your own, besides the fact that it adds to your responsibility and interest in your community. There is also a sentiment in this regard which cannot be computed in dollars and cents.

In most cases, owning a home would also be a good investment. Money not used to purchase a home, but used in the purchase of luxuries or lost in speculative ventures would be far better invested in a home.

An investment in a home is, as a general rule, not an investment for profit. It is an investment for protection, and while, at times, a forced sale would incur a loss, there is always an equity which may be converted into cash, should the need for it arise.

Regarding the investment for profit, a great deal may be said. It is common knowledge that professional men, as a class, could hardly be rated as careful and prudent investors. Promoters of wildcat schemes find ready victims within the ranks of the dental and other professions.

Promises of quick and large returns on the part of unscrupulous promoters are convincing arguments to many dentists, and their hard-earned savings are invested in schemes of all sorts which are absolutely unsound and in which the chance for loss far exceeds the opportunity for gain. Oil stocks, mining stocks, fruit ranches, etc., have been financed to quite an extent by professional men, and the return from these investments have been little or nothing. There is, of course, a possibility of great returns in such ventures, but the chances are largely against you.

What, then, would be classed as desirable investments for a dentist, outside of insurance? There are many forms of investment which could be safely utilized by members of the dental profession. It may be well to consider a few of these. Real estate mortgages have for many years been a safe and convenient form of investment. In recent years, they have been held in slight disfavor. Loans which were made on land during the time of its inflated valuation would, of course, not have the same margin of security when the value of land decreased. In buying mortgages as well as in other forms of investment, it must always be remembered that land values as well as values of commodities and securities are continually rising and falling. The proportion of the amount of the mortgage to the market value of the real estate should always be such that an allowance may be made for some depreciation in the

security, and that the property would realize enough to satisfy the mortgage at a forced sale.

A good rule to follow is not to invest in a mortgage on a farm or other real estate about which you know nothing. A safe procedure here as in any other investment is to buy only what you have knowledge of.

Building and loan shares offer an attractive investment for the person with a limited income. The funds of these companies are lent largely for the financing of homes. The loans are well secured and the proportion of loss is small. The building and loan plan calls for the deposit of a fixed sum with the company every month. When the payments and accumulation of interest have reached a designated sum, this amount is then payable to the depositor, or it may be left with the company and the interest paid out or allowed to accumulate further.

Building and loan societies, in this state, operate under state supervision. Shares in well-managed, established building and loan societies offer a convenient and profitable investment for the small investor. Over a period of years, they have been found to be safe, and they are recommended by financial authorities.

Government bonds and bonds of well-managed, prosperous industrial and public utility companies are, in general, considered sound investments. Government and municipal bonds, ordinarily, offer a smaller return to the investor than industrial and corporation bonds. They are exempt from most taxes which, in many cases, would offset the difference in return.

Bonds bear a specified rate of interest and if the bond is a good one, the interest rate will be conservative. In most cases, they have no speculative appeal. They are simply sound investments, bought by conservative and thrifty persons who do not wish to risk their principal for the sake of possible profits.

In buying bonds, it is always well to seek the help and counsel of your bank or an investment house of proven reputation and responsibility. The ability, experience and integrity of the house from which you purchase your bonds may be your best protection.

A great many persons, in recent years, have invested their surplus funds in common stocks. Common stocks of railroads, public utilities and industrial corporations which have shown their earning power and careful management over a reasonable time may offer opportunities for the careful investor. Stocks, to be placed in this class, must earn enough to pay a reasonable return to the investor, and the prospects of continued prosperity should be favorable. They should be purchased at a price bearing a proper relation to their book value or earning power.

Buying stock in any sound company with the intention of holding it as an investment is one thing: buying the same stock on margin is something entirely different. In the former instance, the stock is purchased and paid for with the object of receiving regular dividends over a period of years. Such stock should be purchased only after the assurance that the company issuing it is sound and responsible. In the second instance, the stock is bought for the increase in value. In other words, it is bought for profit. Until the dentist has acquired a reasonable competence, he is not justified in buying stocks for profit, or engaging in any speculative ventures. He should be in a position where he would accept a loss without any disturbance. If this is impossible, certainly he should not speculate. Most assuredly, he should not speculate if he has not a sufficient estate created so

that the members of his family would not suffer should his operations prove unsuccessful.

There is every possible argument in favor of conservative investments, but there can be few arguments in favor of any form of speculation. The average dentist is not fitted to cope with the financial dangers of speculation. Far better for him that he devote his energies to his practice, and his surplus funds, be they large or small, to some plan of systematic saving.

I should like to close this evening's discussion with a quotation from a paper by C. N. Johnson, read before the Nebraska State Dental Society several years ago.

The science of making or saving money is, after all, a very simple one. Professional men have sufficient intelligence to master this science if they only apply themselves to it. It is my conviction that the time has come when, as honourable, self-respecting citizens, the dentists of this country should approach the study of economics in a more systematic and saner manner than they have in the past, to the end that we shall be known as a profession of level headed and responsible men, rather than as easy marks for every unprincipled promoter.

I want to see my profession rise in the esteem of the world, and one of the means to this end may be found in proving to the world that we have some judgment in the management of our practical affairs. I invite you to closer consideration of this most important subject, with the promise that it will bring tangible returns not only in a material way, but also in self-respect and ultimate happiness.

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THE PATIENT'S NEEDS*

By THOMAS B. HARTZELL, D.D.S., M.D., F.A.C.D., Minneapolis, Minn.

LET us for a moment consider what "The Patient's Needs" implies. First, the patient, a person undergoing treatment for disease or injury. There are 120,000,000 possible patients in the United States. We know from the examination of the mouths of many school children in half a dozen of our great cities that dental defects of one sort or another are prevalent in the great majority. We know from practical experience in our own clienteles that the number of individuals needing dental care is much greater than the one third of the population who consult us.

Therefore, let us divide the population of the United States by three, and let us say, for the purpose of argument, that there are 40,000,000 actual patients in the United States today. Let us also agree that we have 50,000 practicing dentists in our country, which is an estimate. But let the figures stand for the purpose of this argument. If there are 40,000,000 actual patients or individuals who have dental needs (and our dictionary tells us that need implies an urgent necessity), then there are certainly about 40,000,000 people who are possible patients and who have an urgent need for treatment.

If there are 50,000 dentists in practice in the United States to serve these

*Read before the St. Paul District Dental Society, Dec. 10, 1929.

40,000,000 people, each dentist, if he did his share, would of necessity serve 800 individuals. Since, as I feel certain, I have overstated the number of dentists in practice, and also have understated the number of people needing dental service, I think you will agree with me that any discussion of the patient's needs based upon the figures that I have assumed might apply to this problem falls far short of conveying an adequate idea of the number of patients in the United States who have the urgent necessity for help.

The major premise in this proposition is the need of the patient. Therefore, let us visualize what the greatest need of this army of people is. If it is true (and I believe it is true), as Charles H. Mayo says, 70 per cent of human ills begin with disease in the mouth, it necessarily follows that to prevent dental disease is the greatest task confronting the dentist of today.

Our job as the dental profession, therefore, is, first, an educational one. In olden times, the word "doctor" meant teacher. Let us in the profession of dentistry revive that meaning, dentist—teacher—physician. Let us all become teachers, teachers of health.

The next question that we should ask ourselves is: What shall we teach first to these patients. The logical answer is: We must teach them that the immediate cause of dental disease is the product of bacteria growing on the teeth; and in order to impress the patient with this fact, we must visualize to him the bacterial masses so readily to be seen on the teeth if they are properly stained; and explain to him that the holes that come in teeth are caused by the decalcifying action of these masses of bacteria, which he sees as he looks at his own teeth in the mirror; and furthermore that the sore, bleeding gums which exist in almost every human mouth, unless the individual has been taught how to prevent bacterial invasion of the gums, is due to the presence of these stained bacterial masses.

The outstanding fact regarding disease of the tissues surrounding the teeth and the breaking down of tooth surface is that the immediate cause of these two conditions is the presence of an acid waste material which decalcifies enamel and eventually opens the pulp, and a digestive, bacterial ferment which dissolves the epithelium surrounding the peridental membrane and the gingival crevice, and opens the door to an invading army of disease producing cocci, which, as they travel away from the tooth neighborhood, may invade the heart, the joints and the kidneys, and in these various positions cause heart disease and joint disease. In the last two years, Dr. Bell, of the medical department of the University of Minnesota, has shown in the kidneys of monkeys typical nephritis induced by introducing into the blood stream streptococci of the common viridans type.

But I do not wish to obscure the major premise of my paper, the urgent need of the patient to know the facts which concern the diseases of the teeth themselves, that the tooth crown and its foundation are destroyed by bacterial action. These truths need to be emphasized many times, in order that his mind may grip them and he may act to protect himself by combatting the bacteria which set up disease. The patient should be so impressed with the knowledge received at the hands of the dentist that he will proceed to guard himself. He must depend on himself. The dentist and physician can only point the way.

My observation is that most people profit directly by training, teaching and

advice, and the immediate result proves to them that the advice was correct.

The patient's second need is to be taught how to oppose this destructive bacterial activity. This falls under two heads: first, removal or neuralization of bacteria and their products. This calls for effective vigorous methods of cleaning, which the patient needs to be taught; and he needs to be taught also that it takes time to do it well. He needs to be taught just how to manipulate the cleaning instruments, brushes, cotton carriers, toothpicks, etc. He needs to know that a soft wet brush will not help him and that a hard one will. He needs to know just how to apply force to his gums and teeth without damaging them, and he needs to be taught how to tell when his teeth are properly cleaned, which is, of course, by the use of disclosing stain, which he should be taught to use occasionally for that purpose. The next thing the patient needs to know is how to nourish himself in order to repel bacterial activity. This need opens up the whole problem of nutrition.

Some time ago, I made an examination of the pulps of 100 teeth. Twenty-three of these teeth had perfectly sound enamel and absolutely normal gingival epithelium. These teeth were broken open and the pulps removed from them with sterile pliers, with which they were conveyed to sterile culture mediums. Not a single one of the pulps from these twenty-three sound teeth, with normally sound environment, produced growth; whereas about 35 per cent of the pulps of the teeth which had sores in the gingival crevice produced growth, and in about forty teeth showing dental caries, treated in exactly the same manner, the unexposed pulps being removed and dropped into culture mediums, 44 per cent produced bacterial growth. This little experience proves to me that guarding the enamel and gingival crevice prevents infection of the pulp.

The patient needs to be taught all these things. If the enamel coat and the epithelium of the gingival crevice are perfect, pulps do not become infected. So it seems that the first need of the patient is to understand the facts which govern the spread of infection and the destruction of the tooth crown and the tissues around the teeth. After he has reached this understanding through repeated statements by the dentist and comprehends that this vast bacterial mass growing on the tooth sides not only destroys the teeth themselves but their foundations also, and may, in turn, when it diffuses from the tooth neighborhood to other parts of the body, cause disease in those parts of the body in which these bacteria may lodge—when the patient becomes so interested in his own welfare that he strives vigorously to prevent decalcification of the tooth crowns and the destruction of the epithelium which causes sores around his teeth—I repeat, he will then be ready to apply modern methods of cleaning his teeth, and to employ detoxifying agents which neutralize the bacterial poisons left about the teeth. Therefore, his next need is to be taught how to do these things for himself in such an effective way that he will prevent most of the damage which otherwise would occur.

Some dentists may reason that to teach the patient to apply these principles effectively will reduce the work of the dentist to such a degree that it will operate as an economic loss. On the contrary, every patient who is taught how to maintain his own health is so grateful that ordinarily he sends to the dentist much more work to be done for other persons than his own work could possibly amount to. I therefore am in favor of teaching

these things to every patient in this comprehensive way, and I am also in favor of reducing the need for a large extensive restoration by filling all cavities and repairing all evidence of disease in teeth themselves with amalgam while cavities are small. Small amalgam fillings, highly polished and placed early, for a greater number of patients will accomplish greater good than the ideals practiced today, beautiful as they may be. Let us reduce cost and extend the benefits of our service to more people.

Dentistry of today is admirable, and I do not decry it when it is needed, but I do believe that a comprehensive teaching service to all people who need this service will earn us just as great rewards in money and a vastly greater reward in the health, friendship and appreciation of the people whom we serve.

I have emphasized continuously that all my patients must be taught the technic of effective tooth cleaning first suggested by Henry Barnes of Cleveland, and later improved by Morton of Milwaukee and Charters of Des Moines. This technic stimulates circulation in the gums and removes and checks the growth of bacteria.

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LOCAL ANESTHESIA IN RADICAL ANTRUM OPERATIONS

By IRVING WILSON VOORHEES, M.S., M.D., New York City

TWENTY-FIVE years ago (1904), von Eicken described a method of performing the radical antrum operation under local anesthesia before the *Suddeutschen Larngologischen Gesellschaft.* Nager, working in Siebenmann's clinic, wrote enthusiastically about it in 1907.[1] Shortly after this, Hajek expressed himself as well satisfied with the "local radical," as those students will remember who worked with him in 1910-1911 and thereafter. Therefore, what I am setting down here is no new thing; but there are certain phases of the procedure that need to be stressed here in America where the majority of rhinologists seem to favor general anesthesia in radical maxillary sinus operations.

In simple, acute suppurative infections, an opening under the inferior turbinate through the naso-antral wall is helpful for the purpose of irrigation and drainage. It deserves to be used more often than it seems to be used in such cases. I have never been an advocate of daily needle puncture and irrigation with argyrol. This is a medical way of treating a surgical condition, and it is slow and very disturbing to the patient, who frequently expresses dread as each day dawns and calls for another washing in the rhinologist's office.

It is such a simple thing to cocainize thoroughly the inferior meatus and make a large opening in the naso-antral wall. In fact, it is almost as easy as preparing for needle puncture, since one must cocainize anyway. A Faulkner punch, a Myles antrum chisel cutting "on the reverse" or almost any large trocar will serve to make the initial opening, which

1. Nager: Arch. f. Laryngol., Vol. 19, 1907.

can then be enlarged with a curved rasp or the forward-cutting punch of Ostrom. Posteriorly, the opening can be enlarged by means of a sphenoid or ethmoid punch. It is necessary to make a large hole, for the tendency to web and close over is well known to all workers in this field. The inferior turbinate should be infractured toward the middle line so that plenty of room can be had for working beneath this body. It is then possible for the surgeon to wash the antrum as often as seems necessary, and it is quite possible to teach the patient and his friends how to do it at home, if frequent visits to the office are impossible.

Ordinary warm saline solution is very effective in removing the secretion, which should be quite clear after a few moments. Argyrol and the other silver salts make an unpleasant mess for both patient and surgeon, and sometimes seem to stimulate rather than diminish discharge. After trying all of the dyes, astringents, etc., I have settled down to the use of hexylresorcinol, familiarly known as S-T (surface tension) 37, and shall continue to use it until something better comes along. This is only slightly irritating and therefore does not greatly stimulate secretion. It is penetrating and persistent in action and quickly reduces any bad odor to a minimum. It does not stain towels or handkerchiefs and is not at all painful to the patient. The antrum is washed with physiologic sodium chlorid solution, and the S-T 37 is dropped into the antrum while the patient's head is in a lateral position. About 5 c.c. is enough, and it is allowed to remain for two or three minutes before the patient straightens up and lets it flow out. This treatment will clear up the ordinary acute suppurative antritis within a week, provided the antrum is not serving as a reservoir for pus from the ethmoid or frontal sinus. Of course, I am speaking now of a simple antritis of nasal origin. The dental type will demand appropriate management of a necrotic tooth and jaw. It usually calls for radical operation.

What are the indications for a radical operation on the antrum of Highmore? The most cogent reason for so operating is, of course, a condition which cannot be cured in any other way.

There is a tendency for dentists to be too radical in entering the maxillary sinus. One should be very sure of his ground in undertaking this operation; that is, the indications should be very definite, and the operator should be well grounded in the principles of the operative technic. For example, after entering the sinus, one may find that the mucous membrane is not very badly diseased; therefore, it should not be removed *in toto,* but only just so much of it as shows polypoid degeneration or other incurable conditions. It is also well to bear in mind that malignancy of the antrum is by no means rare, and that is surely not a thing to be taken care of by the casual operator, but by a cancer specialist, who must decide what line of treatment, radium or other, he wishes to pursue. Necrosis of the antral walls as a result of syphilis is also not uncommon. I have had such a case where rather extensive removal of the anterior and inferior walls was necessary because of broken down gumma. Of course, in such a case, accurate preliminary diagnosis was paramount. The important thing here was to leave enough of the maxilla that a proper denture could be made when healing was complete. This I did. It was not a case for the dentist, unless he were possessed of considerable experience in this type of antral disease.

I am convinced that there are a large number of "missed" sinus cases of all kinds. In clinic work, it sometimes seems

that every patient who complains of "nose trouble," and in whom such common findings as hay-fever, deviated septum and hypertrophied turbinates are set down in the diagnosis, has an infection of the paranasal cells. A suggestive history is easily obtained, even in the mentally dull. There are frequent colds, a good deal of nasal discharge, commonly spoken of as "catarrh," occasional or even daily headaches, and localized pain over the frontal sinuses or at the bridge of the nose or over the antrums. Many patients recall very frequent "yellow" colds in childhood, which have continued into adult life. Some remember distinctly that it was after scarlet fever, diphtheria or measles that "the nose never seemed to get exactly right." When the discharge is copious, questioning will elicit the fact that a half dozen or more handkerchiefs are used daily. They do not always know about the color of the discharge, but a yellowish or greenish tinge can often be determined by inspection of the nose or a handkerchief. A whitish discharge may come from the sinuses and not from the rather extensive schneiderian membrane of the nasal fossae, but it is, as a rule, limited to the latter and is associated with *Micrococcus catarrhalis.* Silver in some form is probably the best of all agents to combat this type of hypersecretion, but naturally the general bodily condition must be inquired into. For example, cardiac and kidney conditions and diabetes all favor chronic passive congestion of the nasal mucosa, with resultant casting off of exudate.

Pain or headache is not very reliable as a symptom, although it is nearly always present in cases of long standing. Frequently, it masquerades under the cognomen of "neuralgia" or "toothache," and its real origin is quite forgotten or overlooked on the part of the physician. One of our clinic patients had had an attempt made on the left gasserian ganglion, but the operation had to be cut short because of excessive bleeding. He had a small sinus in the left temporal region out of which a small amount of fluid would issue forth at times. Roentgen-ray examination of the head disclosed a left antrum full of pus. A radical antrum procedure helped but did not cure him, and he eventually disappeared in disgust. He was a flighty, highly neurotic individual and had a wide acquaintance with scores of physicians and a rather definite opinion concerning their several abilities—or lack of ability.

Regarding pain over the frontal sinuses, Ross Hall Skillern, of Philadelphia, has made the observation in his book and elsewhere that pain around the eyes is often referred from an antrum. This I, along with many other rhinologists, have confirmed, on various occasions. It should be borne in mind and may help in arriving at a diagnosis and in postulating the future management of the case. When pain is not or has not been present to any memorable extent, it is very difficult to convince the patient as to the need for any operative procedure.

At the moment, August, 1929, I have a private patient, a business woman who has made a name for herself, whose history suggests an old sinusitis of long standing, a sinusitis of the hypertrophic type where the exudate is not great and where pus appears only from time to time, usually, of course, in the presence of an acute coryza. Stereoscopic pictures reveal a foggy right frontal sinus with just the outline of the periphery determinable as compared with a normal left frontal sinus.

At first, one was inclined to the opinion that the right frontal sinus was absent, but closer study showed this conclusion

to be faulty. There is also marked opacity of both antrums, which is due either to pus or "granulations," with the emphasis on the latter. Certainly, there are marked changes in the character of the lining membrane of all these three sinuses, the remaining cavities being quite normal by comparison.

Although this woman is not in good health and is even now journeying to and from various offices of our confrères, she will not hear of any operation, even an "exploratory" one, because she has no pain. A recent letter from a well-known general surgeon asked for light on her nasal condition. She had consulted him for multiple abscesses (boils?) and he was going to begin a course of vaccines, but first wished to know my opinion as a rhinologist who had studied her condition. It is not likely that she will improve very much until an external operation is performed on the frontal sinus and on both antrums. Needless to say, one's scientific curiosity is aroused to the nth power by such a case, and the most valuable lesson might be that which would prove how wrong you can be when you are sure that you are right. However, I feel very positive about the desirability of operation in this instance.

As regards the indication for radical attack on the antrum from the dental side of the question, I have for many years held the opinion that probably the worst operation in all surgery is the so-called Cooper procedure. This consists, as you know, in drawing a tooth, usually the second bicuspid or first molar, and drilling a hole up into the antrum for drainage purposes. It is certainly founded upon a false notion of antral pathology and undoubtedly assists in converting a bad condition into a worse one. After making the hole as large as possible, the dentist will often fashion an obturator or plug, which is kept in place between visits to his office. At such visits, the obturator is removed, the antrum is irrigated and the plug is replaced until "the day after tomorrow." Patients have told me that they have gone back consistently three times a week for six months with little or no sign of relief from nasal pus or nasal insufficiency. General bodily debility has finally taken them to some counselor who has sent them to a rhinologist, and they have been promptly cured by a radical antrum operation.

When necrosis of the maxilla is extensive, a large fistula results from this dental tampering. I have seen a patient in whom three ineffectual attempts were made to suture this necrotic tissue, simply because the pathology of the condition was not understood. A Caldwell-Luc procedure, followed in a few weeks by the employment of a plastic flap taken from the cheek, will cure a large percentage of these unfortunate people. Plenty of time must be given for new substantial tissue to form in and around the defect, and this can be accomplished only by effective antisepsis and scrupulous cleanliness.

Needle puncture for diagnostic purposes does not help much. If foul pus is present, we still do not know whether the condition is acute or chronic, and it makes a vast difference. The acute cases will get well under ordinary conditions without operation other than making an opening in the naso-antral wall. The chronic cases can seldom be cured without radical operation. There can be no great objection to needle puncture and irrigation, but it is a question whether it ought to be a routine procedure, especially if daily repeated as already mentioned. Transillumination is still used by most of us, but when we find one side darker than the other, are we to conclude that this

is a diseased antrum? Possibly so, but if the bone is thicker on this side than the other, we will go far wrong unless there are other signs of positive value.

Roentgenograms are also likely to be misread. It is very important that such plates be stereoscopic and that they be seen and interpreted by the rhinologist himself. A written report from the roentgenologist can be very misleading. It is rather remarkable that he does so well in most instances, since he has no means of checking up on sources of error, as the surgeon has. All plates should be stereoscopic and should be studied thoroughly on the shadow box, with the help of the prism, every possible area being gone over carefully and compared with the opposite side and with the other sinuses. Then when the surgeon *does* operate, he has a perfect check on his preoperative interpretation, and that is invaluable in judging the next case that comes up for diagnosis.

One other point about needle puncture and irrigation: If the antrum contains polypi or thickened mucous membrane, there may be no demonstrable pus in the washing, and it would be a sad mistake to say that no disease was present. To sum up the indications for radical antrotomy: A good history is of first importance. The amount, character and color of the discharge must be known; then the presence or absence of pain, with or without carious teeth and jaw. Finally, antrum puncture and irrigation must be made, preceded by transillumination and stereoscopic roentgen-ray plates. When all of these factors have been duly weighed and considered, we must decide whether to operate or not.

If we assume that the evidence is in favor of an operation, what operation is to be performed? The experience of most men is, at this time, greatly in favor of a Caldwell-Luc procedure. It has only one rival, the Denker, and that was devised because it was thought that the anterior angle, the most common site for recurrence, could not otherwise be reached, that is, the angle made by the plane of the facial wall with the internal or naso-antral wall. But the Denker operation destroys a mass of heavy supporting bone which is seldom or never necrotic except in malignancy. In performing the Caldwell-Luc operation, it is very easy to chisel and bite away the anterior facial wall until the inner wall can be seen and every part of it can be curetted. No angle need be left if this rule is consistently followed. Therefore the Denker has no *raison d'etre*.

Before going into the technic of the "local radical," let us look for a moment at the surgical anatomy of the region, paraphrasing and abbreviating the exhaustive description of Zuckerkandl.

Our chief concern is with the nerve supply. The blood vessels accompany the nerves quite consistently, but give us little concern, as there is little bleeding during the local procedure. The second branch of the fifth cranial nerve passes through the roof of the antrum and emerges as the infra-orbital. Tiny canals branch off from the infra-orbital and course across the facial surface of the bone from above downward, then inward and downward. A similar system of canals begins at the maxillary tuberosity and extends from that area to the floor of the sinus. These canals afford paths for the nerves. The medial one on the facial wall leads to the anterior dental nerve; the lateral ones to the median dental nerve, and the posterior canals to the posterior dental nerves.

Blood vessels, chiefly branches of the internal maxillary artery, accompany these nerves. There is one large vessel in the

anterior wall quite far posteriorly, and if one bites away the bone a little too far back, the bleeding is troublesome, requiring the use of bone wax and other maneuvers before one can proceed. Remembering this, one can avoid it quite well.

The chief importance of understanding this interrelation of nerves is to explain the toothache which not infrequently accompanies antrum disease. The world-famous John Hunter commented on this nerve connection in his writings a century ago.

The naso-antral wall gets its nerve supply chiefly from the posterior palatine branches of the nasal (Meckel's) ganglion. A few branches "stem" from the anterior palatine group through Stenson's foramina to supply the anterior angle above mentioned.

And now for the operation: For the past few months, we have been giving barbital or phenobarbital by mouth in divided dosage, from two to four hours before the operation. It is necessary to establish an interval because this drug works slowly. I have not had sufficient experience with it to say anything about its value; evaluation must come later, but, at this time, we do it as a matter of routine. There is no interdiction of food, the usual meal being taken.

A pledget of cotton saturated with a solution of 10 per cent cocain is tucked beneath the middle turbinate as far back as it can be pushed in order to affect the nasal ganglion, or at least its branches. Another like pledget is placed beneath the inferior turbinate. Both are left *in situ* until the actual taking down of the naso-antral wall, when they are removed. For injection, a 1 per cent solution of procain to which a few drops of epinephrin has been added—about 5 minims to the ounce, to be exact—is made ready in a 10 c.c. glass syringe. The needle should be flexible and strong, about 2 inches in length and of small caliber. So-called spinal needles are not suitable if any other can be obtained.

The injection begins at the frenum and is carried along the proposed line of incision well beyond the last molar tooth. Then, the location of the infra-orbital foramen is estimated. When the eyes are directed straight ahead toward a distant object, the foramen lies about 1½ inches below the pupil. One should hold a finger on this spot and try to inject into and all around it. Sometimes one can strike the nerve quite exactly, when the patient will show discomfort. Although it may not be necessary, I always inject 1 or 2 c.c. in the region of the posterior maxillary dental nerve, and into the anterior and posterior palatine regions.

A postnasal plug is quite unnecessary, but a piece of handkerchief gauze should be placed in the angle of the cheek to catch blood from the incision. The suction pump should be in working order to take away saliva, blood or pus. It is very useful within the antrum also.

There is no need to wait for the anesthetic to take effect. The usual incision is made midway between the gum margin and the angle which the cheek tissue makes with the mucous membrane covering the anterior wall. If the incision is too close to the teeth, subsequent suture is difficult; and if too high up, the fold will be destroyed by scar-tissue contraction. Elevation of soft parts is now carried out until the infra-orbital nerve is located at the foramen. One can then test the anesthetized area and inject more of the anesthetic if necessary.

A fine chisel is used to break into the antrum at the canine fossa. Here, the bone is quite thin. As soon as an opening

is thus made, it is enlarged with a small Spratt curet followed by any one of the punches often described as the Hajek or Kerrison instrument. The work will proceed a little more rapidly with small rongeurs, enough bone being removed to admit a finger or to give a good view of the entire cavity. If pus is seen, a culture should be taken.

With fine elevators such as one uses in septum work, the lining tissue can be well loosened from the bone and removed in large masses. It is well to remove all soft tissue as it is probably diseased and might defeat the purpose of the operation if left behind. Myles has given us various curets which are excellent for this purpose, as they fit into every corner or angle of the cavity.

When the anterior angle is destroyed as mentioned above and the naso-antral wall fully denuded, we are ready to make the opening into the nose. At this time, the cocain pledgets are removed and the inferior turbinate is "infracted" toward the middle line so that it touches the septum.

None of the inferior turbinate should be removed unless there is much hypertrophy. In any case, it can be done as an office procedure at any later sitting, and may never become necessary after the antrum disease is cured. In earlier days, a large part of the inferior turbinate used to be taken away. This was standard procedure in the old textbooks. Very often or whenever the patient leaned forward as at table, discharge would drop out, causing great embarrassment. Later on, the nose would be too spacious and, of course, very dry. The inferior turbinate acts as a valve over the surgical hole and thus has an important function.

One can now take a small flat chisel and plot out the removal of a rectangular piece of bone which should represent the naso-antral wall, but not extending above the line of attachment of the inferior turbinate. Intact mucuous membrane will be seen lining the nasal side of the opening. One should take a knife and cut this along its upper margin just below the attachment of the inferior turbinate, allowing it to fall in upon the floor of the antrum. It is important that no ridge be left along the floor, as secretions would then have to "climb up" in order to be discharged into the nose. In other words, the bone edge should be flush with the floor of the nasal fossa. There is so much likelihood of "webbing" and possible closure of this surgical fistula that it is sometimes better to destroy the nasal mucous membrane than to attempt making a flap which is of doubtful value anyway.

Before removing the lining of the antrum, one should go over the surface carefully with a small pledget of gauze held in an artery clamp saturated with 20 per cent cocain solution. Great care should be taken that there is no excess in the little pledget or the solution will run through the normal opening of the antrum into the throat and, if swallowed, will set up undesirable symptoms.

The cavity is now sponged out with gauze dipped in peroxid and wiped dry so that the entire interior can be inspected. This done, a curved artery clamp is inserted through the nose into the antrum. Narrow gauze in a glass tube is saturated with tincture of iodin, in a 1.5 per cent solution, but again excess of iodin must be squeezed out of the gauze or it will run into the throat, causing gagging and unpleasant symptoms. The end of the gauze is grasped in the jaws of the artery clamp and pulled through the nostril. Then, the antrum is packed snugly but not tightly, and we are ready for the suture.

There are many opinions regarding suture, from those of men who think it unnecessary to sew up the wound at all, to those advocating removable stitch material such as linen, silk or horsehair. If no suture is used, there is some chance of the formation of a permanent fistula which will require a plastic operation later on. Therefore, I think it is better surgery to suture in every instance.

Why one should use anything but gut it is hard to see. After silk, for example, is in place for a few days, it is very hard to find, and its removal causes the patient some distress, both actual and imaginary. The same is true of anything else except gut. For years, I have closed the wound with either No. 0 or No. 1 chromic gut. A short full-curved Mayo needle is used such as is in order for cleft-palate surgery, and a chain or button-hole stitch of the running variety is put in, beginning at the external angle of the wound and working toward the frenum. The needle should be inserted from above downward, for if inserted from below upward, it is difficult to turn and may break owing to the jaw's acting as a fulcrum. When the suture line is completed, one need scarcely give it another thought, as the gut is digested in a few days. If any exuberant granulations appear in the stitchline, an application of silver will take care of them. About twenty-four hours after operation, the gauze is removed, because it is a foreign body and is no longer of use after the bleeding has been thus controlled. I have tried to do without packing the cavity at all, but the postoperative bleeding was troublesome.

At the end of forty-eight hours, the patient is allowed to leave the hospital if he so desires, and he then becomes ambulant, visiting the surgeon's office for inspection two or three times a week. Under ordinary circumstances, no cannula is introduced into the antrum. A warm saline solution is permitted to wash through the nasal fossae, some of which goes into the antrum and is allowed to run out when the patient's head is lateralized. If any odor persists, about 5 c.c. of hexylresorcinol is dropped into the antrum and allowed to remain there for a few moments. The patient uses the hexylresorcinol at home also every four hours until neither pus nor odor is detectable. As a rule, the patient is clinically well in about two weeks. The longest time from the day of operation to dismissal has been four weeks. According to Hajek, complete covering over of the bony wall requires from six months to one year. This process goes on *ad naturam* and need not be interfered with. It makes no difference how long it takes, provided the patient is free of his former symptoms.

It goes without saying that there are some patients on whom no local operation should be undertaken. The sights and sounds of the operating room, instruments, surgeons and nurses, blood — in short, "the thoughts of the thing"—are abhorrent. There is, nevertheless, a large group of tolerant individuals on whom a local radical Caldwell-Luc operation is a striking success.

114 East Fifty-Fourth Street.

EXTRA-ORAL REMOVAL OF THE MANDIBULAR THIRD MOLAR IN MALPOSITION: REPORT OF THREE CASES

By MATTHEW N. FEDERSPIEL, D.D.S., M.D., F.A.C.S., Milwaukee, Wis.

OCCASIONALLY, patients are troubled with mandibular third molars that are in a malposition and deeply embedded within the jaw bone.

The following three cases are interesting because of the extra-oral removal of the third molar without any postoperative complications.

CASE 1.—*History.*—L. K., a man, aged 31, complained of pain in the region of the mandibular third molar on the left side complicated by trismus of the jaw. About four years previously, his dentist had extracted the left mandibular second molar which he believed had been causing the pain. After the removal of this molar, the pain subsided; but, several months later, the patient again experienced pain, which came on periodically in the angle of the mandible, radiating upward into the temporal region. During the last few months, he had noticed a swelling of the soft structure beneath the jaw bone, and experienced considerable difficulty in opening his mouth. The jaw felt stiff. The patient appeared to be well nourished, his general condition was good and he was able to continue his work as a carpenter without loss of time from ill health. The local pain in his jaw, accompanied by trismus, was annoying to the extent of causing him anxiety and worry. He feared that he might develop lockjaw. (Fig. 1.)

Examination.—His teeth appeared to be clean, and there was no evidence of gingival irritation. There was considerable trismus. He could open his jaw to the extent that a mouth mirror could be inserted, but this caused him much pain.

The occlusion of his teeth was anatomically correct, and the only missing teeth were the lower left second and third molars. The tonsils and mucous membrane of the pharynx and oral cavity appeared to be healthy. The left submaxillary gland was enlarged. The white blood count was 12,500; the temperature, 99.06. A roentgenogram of the left mandible revealed a displaced third molar lying at the lower border of the mandible. The area surrounding the tooth above the crown showed evidence of undergoing degenerative changes, probably caused by pressure of a follicular cyst, which so frequently is associated with misplaced and embedded teeth. (Fig. 2.)

Fig. 1.—Jaw trismus with a slight swelling in the left submaxillary region.

Preoperative Diagnosis.—Perversion of the left mandibular third molar complicated by an infected follicular cyst was diagnosed.

Operation.—The patient was advised that surgical care would be necessary to obtain a cure. He readily consented to this, and was referred to the Marquette University Hospital, to be operated on the next day. Under general anesthesia (ether) an incision 2 inches long was made beneath the mandible. The soft tissues were separated and retracted in order to expose the outer wall of the mandible. The bone covering the imprisoned tooth was cut away with a surgical bur. (Fig. 3.) An opening was made large enough to remove the tooth.

Fig. 2.—Displaced third molar with an infected follicular cyst.

Fig. 3.—Retraction of soft tissues to expose the bone; removal of the bone covering the tooth.

Fig. 4.—Wound closed permitting gauze to protrude.

The cutting of the bone with a surgical bur is extremely gratifying to the operator who wishes to do accurate and quick work. Its use is more advantageous than the use of bone chisels, especially if one is well provided with an assortment of well-tempered sharp burs. If the burs are dull, the cutting process is not accomplished with ease, and may produce enough friction to cause a bone burn. If this happens, the healing process is retarded, there is much pain and postoperative infection may develop.

A gear driven Dumore surgical engine with the usual S. S. White handpiece was used. The cable was washed with a 25 per cent solution of lysol (compound solution of cresol) and covered with a sterile muslin sleeve. The handpiece was boiled and lubricated with sterile oil. The burs were sterilized in a 95 per cent solution of phenol and then washed in sterile water.

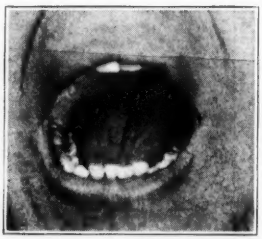

Fig. 5.—Ability to open mouth two weeks after operation. This could be done without strain or tension.

The cutting away of the bone to release the imprisoned tooth took but a few minutes. After the tooth was removed, the cavity was found to be infected and partly lined with remnants of a follicular cyst membrane.

The cavity was thoroughly curetted and cleansed, then swabbed with glycerozinc iodin and lightly packed with 5 per cent iodoform gauze. The wound was closed with dermal suture, the gauze protruding to allow drainage. (Fig. 4.)

After-Care.—Twenty-four hours after the operation, the gauze was removed, and narrow strips of 5 per cent iodoform gauze were replaced in the wound to permit further drainage. The next day, the gauze was removed, and the wound was gently irrigated with a 50 per cent solution of hexylresorcinol and dressed with a dry gauze bandage. The sixth day, the sutures were removed. The patient was able to open his mouth quite freely. (Fig. 5.)

CASE 2.—*History.*—M. S., a man, aged 43, a painter, weighing 190 pounds, complained of excruciating head pains and jaw trismus with a swelling in the region of the posterior angle of the left mandible.

Examination.—The temperature was 99.06, the urine negative except for a slight trace of albumin. Because of the pronounced trismus, close inspection of the mouth was difficult. The following teeth were missing: upper left first and second molars; upper right first bicuspid, and first and third molars; lower left first bicuspid and first, second and third molars; lower right first, second and third molars. The roots of the upper left lateral incisor and third molar were diseased and decayed. The remaining teeth were stained, and the gingiva was undergoing chronic inflammation. The swelling was about the size of a hen's egg. On palpation, the mass was found to be hard, firm and slightly painful. A roentgenogram of the swollen area revealed an unerupted molar deeply buried within the structure of the mandible. (Fig. 6.)

Diagnosis.—Unerupted third molar accompanied by an infected follicular cyst and complicated with osteitis which had developed into a subperiosteal abscess was diagnosed.

Operation.—An incision 2½ inches long was made beneath the border of the mandible. Considerable pus was liberated from the opening. The soft tissues were peeled away from the bone, the area being sufficiently exposed to permit the cutting of a window in order to remove the imprisoned tooth. This operation was done at the hospital under nitrous oxid-oxygen anesthesia.

A surgical bur was used to cut away the bone in order to expose the embedded tooth, which was found to be surrounded by a cyst wall partially broken down and filled with a thick purulent yellowish gray pus. The tooth socket and surrounding infected area was thoroughly cleansed and irrigated. The cavity was gently packed with iodoform gauze, which was permitted to protrude externally in order to provide drainage. The greater

Fig. 6.—Unerupted third molar with infected cyst.

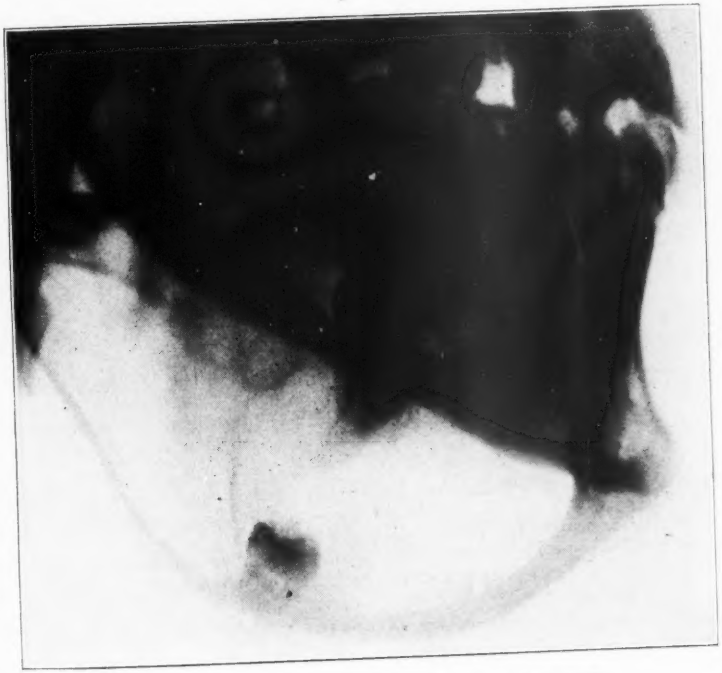

Fig. 7.—Large follicular cyst with a displaced third molar.

part of the wound was closed and kept so with silk ligature.

Results.—This case required twenty days of postoperative care. At the end of this time, drainage had ceased, and the wound was apparently healed. The patient was discharged as cured and instructed to return in four weeks for further observation. When he returned, the tissues had assumed their natural form; the swelling had disappeared, and he was again able to open his mouth freely and easily.

CASE 3.—F. J., a man, aged 27, was referred by his dentist, who had discovered that the right mandible was thickened. The patient had not suffered any pain, and the general health was good. A roentgenogram of the jaw revealed a large cyst with an unerupted third molar. (Fig. 7.)

Diagnosis.—A large follicular cyst with an unerupted third molar was the tentative diagnosis. Operation was advised and the patient was referred to the hospital.

Operation.—The next day, under general anesthesia (ether), an incision was made beneath the mandible of the jaw, and the soft tissue stripped from the bone. The external plate of the jaw was found to be very thin and could be easily removed. A large cyst was found, containing a semitransparent fluid, which was evacuated. The third molar could be seen within the sack. (Fig. 8.) The bone cavity was enlarged and the cyst wall and tooth removed. (Fig. 9.) The cavity was lightly packed with iodoform gauze, and the soft tissues brought together and held so with silk ligature.

Results.—After forty-eight hours, the gauze packing was removed. The wound was dressed daily, and after two weeks, the patient was dismissed as cured.

Fig. 8.—Large cyst and third molar within bone structure.

Fig. 9.—Removal of cyst after evacuating fluid and removal of tooth.

695 Astor Street.

A STUDY OF THIRD MOLAR TEETH*

ALBERT W. GOBLIRSCH, D.D.S., Rochester, Minn.

THE third molar is perhaps the most interesting of all the teeth in the human being. This is evidenced by the fact that it is so often the leading topic at dental clinics, and by the number of papers relative to it published in journals. Dentists are continuously faced with the question of extracting or preserving this tooth.

There is a greater variation from the normal condition in occlusion of the teeth in relation to the third molars than to the other teeth. They are abnormal in a relatively large number of cases; they are malposed, impacted, decayed or undeveloped, which is probably accounted for by the fact that these teeth are the last to take their places in the normal arrangement.[1] If there is deficient development of the jaws, there is not sufficient room for teeth to develop and to erupt normally.

Certain writers believe that the degeneration of the jaws is the result of the process of evolution. Gregory, in his book, "Evolution of the Human Dentition," stated: "The third upper and lower molars are greatly delayed in eruption, especially among higher races, and are evidently decadent teeth which may eventually be entirely lost." Darwin, in "The Descent of Man," said:

> It appears as if the posterior molars, or wisdom teeth, are tending to become rudimentary in the more civilized races of men. These teeth are rather smaller than the other molars as is likewise the case with the corresponding teeth in the chimpanzee and orang. They do not cut through the gums until the seventeenth year and I have been assured that they are also more liable to decay and are lost earlier than the other teeth. In the Melanesian race, on the other hand, the wisdom teeth are usually furnished with three cusps and are generally sound; they also differ less from the other molars in size than in the Caucasian races. Professor Schaffhausen accounts for this difference between the races by the posterior dental portion of the jaws being always shortened in those who are civilized, and this shortening may be attributed to the civilized man's habitual feeding on soft food and thus using the jaws less.

At the present time, this progressive degeneration of the jaws of human beings has not been proved clinically. Conditions which interfere with the normal development of the jaws, such as malnutrition, disease, habits of childhood and traumatism, would predispose to a condition favorable to pathologic dentition. The last tooth in the dental arch, regardless of the size of the jaw, will have less to do than the molar teeth anterior to it. Therefore, use and position determine the size of a tooth to a large extent. The active interference of the dentist is another factor to be considered.

*From the Section on Dental Surgery, the Mayo Clinic.

1. Lyons, C. J.: Etiology, Pathological Significance and Treatment of Impacted and Unerupted Teeth, Dent. Cosmos, 63:1216-1222 (Dec.) 1921.

UNDEVELOPED AND IMPACTED THIRD MOLAR TEETH

A study of unerupted third molar teeth in 2,112 patients has been made at the Mayo Clinic. Each patient was questioned thoroughly to determine whether the absent molars had been extracted or never had developed. If definite information could not be obtained, the case was not recorded. A complete roentgenographic examination of the mouth was made in all cases. The ages varied from 19 to 78 years, with an average age of 37. The ratio according to sex was three males to two females. All nationalities found in the United States, with the exception of the colored races, were well represented. Any peculiar general ailment was not noted in the patients with undeveloped molar teeth, as shown in the accompanying table.

DATA CONCERNING THE DEVELOPMENT OF THIRD MOLAR TEETH IN 2,112 PATIENTS

Degree of development of molars	Molars	Cases	Percentage
One or more third molars undeveloped ...	..	191	9.00
All third molars undeveloped	..	49	2.33
Both upper third molars undeveloped	..	37	1.75
Both lower third molars undeveloped	..	29	1.40
Upper left third molar undeveloped	115	..	...
Upper right third molar undeveloped	110	..	...
Lower left third molar undeveloped	111	..	...
Lower right third molar undeveloped	106	..	...
Total third molars undeveloped	442	..	...

The number of third molars that should be present normally in 2,112 patients is 8,448. The percentage of third molars undeveloped in this series was 5.2 per cent. In 191 patients, at least one of the third molars did not develop. Thus, in 9 per cent of all persons, or almost one of every ten, at least one of the third molars does not develop, and 5.2 per cent, or one in every twenty third molars, never develop. The individual counts show that the percentage of lack of development of upper and of lower molars is approximately the same. Of the 191 patients in whom one or more third molars were undeveloped, the number of males and females was approximately even. Judging from the ratio according to sex, three males to two females, in which development of the molars failed, third molars do not develop in males as often as in females. It might be noted that women, as a rule, remember personal statistics more accurately than men.

These percentages do not prove that the third molar is a decadent tooth. There are no previous records on this phase of the subject, so a means of comparison does not exist. The third molar, in spite of the shortening of the jaw, continues to exercise its function. The ill consequences and disadvantages of impaction are removed by its extraction, and the patient is enabled to compete for existence with little trouble. If the dentist does not take an active part, a great deal of energy will be required to combat infection and other consequences of impaction. Thus, we have, through the dentist, an active force of adaptation. From this, it can be concluded that the third molar will not disappear from the jaw of man, but will remain probably in a rudimentary condition.[2]

As previously stated, the third molar is impacted in a relatively large number of cases and brings about both local and

2. Levine, J. H.: Third Molar in the Evolution of the Jaw, Dent. Cosmos, 59:1203-1207 (Dec.) 1917.

general complications. Ito recently made a complete list of the causes of noneruption of third molars.[3] I believe that lack of space and displacement of the tooth bud in the embryonic stage accounts for most cases of impaction of third molars. It is claimed that cases of impacted molars seem to be increasing in number, but it must be remembered that the number of roentgenograms taken today is considerably larger than the number taken a few years ago.

Some of the general disturbances which, it is claimed, are due to impacted molars are as follows: facial paralysis, neuralgia, headaches, epilepsy, otitis media, insomnia, melancholia, mania and paralysis of the arm.[4] Local disturbances are cysts, absorption and decay of the adjoining teeth, acute and chronic infections, cellulitis, odontalgia, malocclusion and inflammatory reactions of the hard and soft tissues.[5] Whether or not some of the general symptoms mentioned are due to impactions is a debatable question. Much has been written on the subject, but it is still largely a mystery. The exact etiology and nature of the pain caused by impactions is not known. Undoubtedly, these teeth are contributive factors in many cases of disease.

Cases in which the region of impaction has an external communication or in which it communicates with an abscess of an adjacent tooth are often associated with acute or chronic infection occurring in the jaws and throat. This is particularly true of impacted lower third molars. Infection may easily enter under the flap of gum which partially covers these teeth. This pocket is an ideal incubator for bacteria and cannot be kept clean by the patient because of its site and formation. The foul odor and disagreeable taste which frequently occur in mouths are often due to pus and to putrefactive particles of food that are found in these pockets. Constant biting on these flaps tends to inflame them and lowers the resistance of the tissue. The state of the patient's health is also a factor that may aid or retard the infection. These infections are very serious, and if not treated, may lead to a fatal issue.

Streptococcus pyogenes is the organism most frequently found in infections that tend to spread; whereas, in the more localized forms, the staphylococcus is the

Fig. 1.—Impaction, showing the dentinal follicle which surrounds the crown. This follicle is not a very dense tissue and affords enough space, even though there is no loss of bone, for an incubating place for bacteria.

Fig. 2.—Formation of a pocket about an impacted lower third molar.

3. Ito, F. H.: Clinical Pathology of Non-Erupted Mandibular Third Molars Including a Bacteriological Study of the Involved Dental Pulp, Dent. Cosmos, 71:449-459 (May) 1929.

4. Lyons, C. J.: Pathological Significance of Impacted and Unerupted Teeth, J. N. D. A., 3:28-46 (Jan.) 1916.

5. Tholen, E. F.: Dental Impactions and Their Sequelae, J. A. M. A., 81:1664 (Nov. 17) 1923.

prevalent organism.[6] The extent of infection depends, of course, on the virulence of the organism and the resistance of the patient. Infection which is only acute at first may develop in a lateral direction, with retention of purulent exudate in the tissues of the cheek. The pyogenic cocci have then increased in numbers sufficiently to cause gangrenous destruction of the peridental membrane, the alveolar crests and the surrounding structures and vessels. Accompanying symptoms may be involvement of the submaxillary or sublingual glands, tonsillitis, acute otalgia, trismus of the masseter muscle, false ankylosis of the temporomandibular joint and myositis of the internal or external pterygoid muscles.[7]

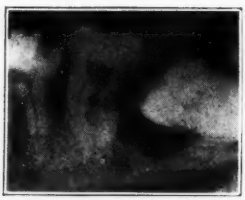

Fig. 3.—Pocket formation about a lower third molar; condition farther advanced than in Figure 2.

In few cases, if treated, is there a tendency to suppuration. Recurrence of Vincent's infection cannot be prevented with pockets such as these present. Whenever any such infection is present, it should be treated and brought under control before extraction is attempted. Extreme care should be taken to prevent the spread of infection to the other parts of the mouth. Third molars which cannot erupt, as revealed by the roentgen ray, and which have a flap of gum with an external opening, should be extracted as soon as is feasible. Partial impaction is a potential danger, with abounding pathologic possibilities.

In some cases, there is only a slight cuff of gum extending forward over the distoclusal margin of the tooth. Attempts to resect this tissue and bring the cuff down on the distal surface of the tooth are usually not very successful. The tissue has a strong tendency to grow back to its original position, and the region is often extremely sore for some time after the operation.

Fig. 4.—Decay in an upper second molar caused by an impacted third molar.

FORMATION OF POCKETS AND DESTRUCTION OF BONE IN IMPACTED TEETH

In an examination of 1,700 complete roentgenograms of the mouths of patients with one or more impacted third molars, both upper and lower, a record has been made of the formation of pockets and destruction of bone about these teeth. A clinical examination was not possible, and a definite statement as to whether or not there was any external communication cannot be made. In cases in which a definite layer of bone entirely surrounds an impacted tooth, there seldom is any external communication, but the majority of impacted teeth, at the most, have only

6. Cahn, L. R.: Acute Pyogenic Infections of the Jaws Not Associated with Pulpless Teeth, Dent. Cosmos, 65:227-233 (March) 1923.

7. Bloch, Harry: Recognition and Treatment of Infections Involving the Region about the Lower Third Molars, Dent. Cosmos, 63: 148-153 (Jan.) 1921.

a thin shell of bone covering the surface toward the occlusal margin. When the tissue of the gum which covers these regions becomes inflamed and bruised from biting and irritation, the seal of the impaction is easily broken. The dentinal follicle which surrounds the crowns of these teeth is not a very dense tissue and affords enough space, even though there is no loss of bone, for an incubating place for bacteria. In Figure 1, this fact is illustrated clearly.

Impacted third molars, with a distal inclination, no external opening and no contact with adjoining teeth, are not likely to cause much trouble, except for pressure on the mandibular nerve. Unerupted third molars, in their attempt to erupt, tend to follow the path of least resistance. In the maxilla this direction is toward the disto-occlusal aspect; whereas, in the mandible, it is toward the mesioclusal aspect. Thus, different conditions prevail in upper and lower molar regions. Impacted upper third molars usually face distally, and as a rule cause little disturbance. Also, they are kept clean much more easily than the lower molars.

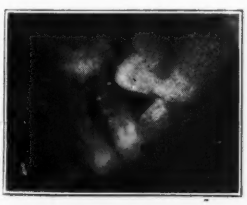

Fig. 5.—Type of impaction which most frequently causes decay in adjoining teeth. The contact point is confined to a very small area.

The following data were obtained from the 1,700 sets of roentgenograms examined: The average age of patients was 36 years, varying from 17 to 70. The incidence in the sexes was approximately equal. The total number of impactions of the third molar was 3,059, of which 1,457 involved upper third molars. The impacted upper third molar was in contact with the second molar in 371 instances.

Impacted upper third molars were practically normal as far as formation of pockets, destruction of bone and decay and resorption of the adjoining teeth are concerned.

The number of impacted lower third molars was 1,602. The impacted lower third molar was in contact with the second molar in 904 instances. Formation of pockets and destruction of bone was noted in 588 (37 per cent) of the impacted lower third molars. Of the 588 teeth, there were 410 in which there was contact between the second and third molars.

The extent of formation of pockets varied. In 172 of the 588 areas, there was marked formation of pockets, as shown in Figure 2. In forty-three areas, the process was still farther advanced, as illustrated in Figure 3.

Cystic regions were rare. Only eight lower dentigerous cysts were noted.

The decay caused in adjoining teeth by these impactions was also noted. Of the 3,059 impacted teeth, sixty-nine caused decay in the second molar. Of this number, only ten were in the upper jaw. Figure 4 shows evidence of decay caused by impaction in the upper jaw. Decay occurs most frequently in the type of impaction shown in Figure 5. In this type, the point of contact between the second and third molars is confined to a small area and the pressure exerted by the impaction is more effective in causing decay and resorption. Decay rarely occurs in types of impaction in which

there is no external communication. In such types, particles of food and oral fluids, along with bacteria, are not permitted to enter the pocket.

COMMENT

If all of the foregoing facts are borne in mind when one is debating whether to extract or retain a third molar which may or may not cause trouble, the question can readily be solved. The fact that the majority of cases of impaction in the lower jaw are accompanied by destruction of bone and formation of pockets, the possibility of decay and resorption of adjoining teeth and other possible consequences mentioned before certainly warrant the removal of these teeth without much delay.

SUMMARY

In 9 per cent of all persons, or almost one in every ten, at least one of the third molars does not develop. Five and two-tenths per cent of all third molars, or one in every twenty, do not develop. The third molar probably will never disappear from the human jaw but will remain in a rudimentary condition. Third molars which cannot erupt and which have a flap of gum with an external opening should be extracted as soon as feasible. Impacted third molars, with a distal inclination, no external opening and no contact with adjoining teeth seldom cause much trouble outside of pressure on nerves. In 37 per cent of impactions of lower third molars, there is formation of pockets and destruction of bone.

HISTORY OF VINCENT'S INFECTION*

By FRANCIS H. DALEY, D.M.D., Boston, Mass.

TO an American dentist, W. D. Miller, must go the thanks of the present-day oral bacteriologists and pathologists, for his admirable work on the bacteriology of the human mouth, which, though written almost five decades ago, is still authoritative among such publications. When we consider the difficulties under which he labored, we cannot but admire the spirit which urged him on in such laboriously technical research.

During the past three and one-half decades, a disease involving the oral mucous membrane has become generally recognized. This infection has run the gamut as to terminology until the present term, Vincent's infection, has been evolved. Suffice it is to say here that the disease is characterized by the formation of ulcero-membranous lesions appearing on the oral mucous membranes. With these lesions, we always find associated a type of fusiform bacillus and a spiral form or borrelia.

The history of the disease is both interesting and instructive. In reviewing the literature on pathologic conditions of the oral cavity, one can follow the course of the disease from a comparatively rare or unrecognized condition up

*This is the first of a series of papers on Vincent's infection by Dr. Daley. The bibliography, containing more than 300 references, can be had on application to the author.

to the present time, when, we must admit, it is one of our more serious dental problems as to both dental pathology and dental therapeutics. To give a complete history of the disease, it is necessary that a wealth of detail be amassed, and a review of each individual paper would be a physical impossibility for a paper of this character. We shall, therefore, take cognizance only of the outstanding factors concerning the disease, and later in discussing the various phases of the disease shall include some few of the more important historical details.

Dr. Miller, in his study of the organisms of the mouth cavity, was the first to describe the organisms which we commonly associate with Vincent's infection. He described them and drew the conclusion that they were normal inhabitants of the oral cavity. Babes, in 1884, confirmed Millers's findings and also described them in connection with ulcerations of the tonsils. Vincentini, of Italy, in 1888, in his work on *Leptothrix racemosa,* described the fusiform bacillus and drew the conclusion that it was an end-product or offspring of the pleomorphic *Leptothrix racemosa.* The Vincentini here mentioned must not be confused with Vincent, the Parisian physician, from whom the infection derives its name.

J. D. Patterson, of Kansas City, in 1891, described lesions of the oral mucous membrane which simulated Vincent's infection. R. G. Richter, of Milwaukee, in 1891, described two cases of ulceromembranous gingivitis which are identical with the condition which we recognize as Vincent's infection. These cases were published as sequelae to cases of influenza.

The year 1892 was marked by the writings of Charles Lee, of Paris, on the tissue resistance of the oral cavity. Lebidinsky contributed to the bacteriology by further discussion on the fusiform bacillus and its relation to the leptothrix; and Grant Mitchell presented an admirable treatise on oral pathology and oral resistance to infection.

Vincentini, again in 1893, published more on the bacteriology of the leptothrix. Babes, at this time, claims to have found the organisms in histologic specimens of gingival tissue. He says that the organisms noted in the tissues were of a slightly shorter type than those described by other observers, but he thought that they were the same. Rauchfus, a Russian, is said by Tarassiewicz to have demonstrated the fusiform bacillus and the borrelia in ulceromembranous angina, in 1893. This, if authentic, would place the work of Rauchfus three years ahead of Vincent's.

In the period from 1893 to 1906, much discussion took place as to the pleomorphic characteristics of *Leptothrix racemosa.* The most prominent figures in the controversy were Vincentini, of Chieta, Italy; Goadby and Mummery, of England; Watson, of Scotland; von Beust, of Dresden, Germany; J. Leon Williams, Blue, of Kentucky, and Bantock.

In 1894, Plaut described the organisms and the lesion of the disease. He connected the presence of the fusiform bacillus and the borrelia with the production of the lesions. Vincent, a physician of Paris, for whom the disease was named, published his findings on several cases in 1896. It is interesting to note here that, although the condition was hardly recognized as a distinct disease of the oral cavity, several forms of treatment were advocated. Both systemic and local treatment was advocated. G. H. Winkler, in 1895, advocated the use of creosotum, internally, as a specific for the treatment for ulceromembranous

stomatitis. Stackhouse advocated the local application of trichloracetic acid on the lesions. Jerome H. Allen, in 1896, brought out the fact that the fetor of the breath was due, in most cases, to unhygienic mouth conditions, and gave salivary calculus and such irritants as etiologic factors in the production of the disease.

Bernhiem, in 1897, published a report on thirty cases of the disease, and Vincent, in 1898, reported on twenty or thirty more. Miller, in 1898, published an article dealing with the symbiotic tendencies of the organisms.

The literature from 1899 to 1904 is strangely lacking in detailed account. There seems to have been a temporary lull in organized work on the disease.

Emil Mayer, of New York, in 1902, seems to have been the first man in the United States to recognize and report the condition as Vincent's infection. The foreign writers were recognizing the condition, and many reports are found from this time on. It seems that the condition probably had its inception in continental Europe and finally was brought to this country.

In 1904, we find an article by A. Hofman and E. Kuster dealing with the bacteriology of noma; they reported the finding of the fusiform organisms and the borrelia constantly in the lesions of noma. In 1905, the first real attempts at organized research from a bacteriologic standpoint were carried out by Tunnicliff and Weaver. In 1906, Tunnicliff, working alone, carried out further experiments. Their findings seemed to show that the two organisms associated with the disease were merely two different forms of the same organism.

Robet, of France, in 1905, did his work on the value of soaps in controlling infective processes. Reasoner and Gill, in 1927, amplified this research.

George W. Cook, of Chicago, in 1907 and 1909, carried out some interesting experiments on the resistance of the oral mucous membranes. His work brought out the fact that strong astringents constantly used would, after a period of time, cause glycogenic infiltration and mucoid degeneration of the cells of the mucous membrane.

Simms, of London, and Ferris, of Brooklyn, both contributed articles of value in 1907. Barden and Cruet, both of Paris, reported on the disease in 1909. In 1910, von Beust, then of Dresden, Germany, contributed an article on pleomorphism of mouth organisms. Timothy Leary, of Boston, published an article dealing with the bacterial flora found in cases of pyorrhea alveolaris. His findings showed that the organisms of Vincent's infection were present in practically all cases. De. Sotolongo, of Havana, Cuba, also published a treatise on the disease in 1910.

T. S. Gilmer, of Chicago, published his findings on the disease at this time. He was one of the pioneers in the study of the infection.

Brown, of Milwaukee and Crofton, of Chicago, in 1911, published articles on diseases which affect the mucous membranes of the oral cavity. Tunnicliff had another article published which gave the results of further studies on the fusiform bacillus. An interesting case of genuine gonorrheal stomatitis was also reported by Zilz, of Vienna, in 1911. Sibley, of London, in 1911, published his work dealing with the relation of teeth and diseases of the skin and mucous membrane.

The year 1912 showed an increase in the number of reports on the disease. Vaughan, of New York, published his

article dealing with the infection. The article was the first really comprehensive treatise on the disease published in this country. Thibaudeau, of Buffalo, and Rhein, of New York, were other contributors. Zilz of Vienna, in 1912, brought out the fact that arsphenamin was effective in combating fusospirillary infection of the mouth. Zimmern, of Berlin, published his results on the effect of arsphenamin on the teeth.

In 1913, Guibad, of Toulon, France, and Citron, of Berlin, advocated the use of systemic disease to oral infection. Grieves, of Baltimore, in 1913, reported as to his findings from a study of mouths which showed a lack of proper hygiene. Stewart and Gildersleeve, both of Philadelphia, published papers on the relation of systemic disease to oral infection. These were brought out in 1915. Ozaki, also in 1915, did some work on the anaerobic bacteria of the mouth.

Hinman, of Atlanta, in 1916, published a paper dealing with the disease which amplified Vaughan's findings. Favre and Doreyfauss, of Paris, studied and reported on the treatment of the disease.

In 1917, McClintock, of Philadelphia, and Bowman, of the Canadian expeditionary forces, reported on the disease. Campbell and Dyas, Taylor and McKinstry reported on cases of the disease among the troops at the front.

In 1918, Haines of Philadelphia and Hubbard of Toledo were among the outstanding contributors. Bowman, in this same year, published an article containing what were probably the first definite statistics on the disease.

In 1919, Clarence J. Grieves, of Baltimore, published one of the clearest and most comprehensive articles which has been written in this country. Redden and Beuhler, both of the Army Dental Corps, and Nodine, of New York, were other prominent contributors in this country.

Cahn of New York, McDonald of Baltimore, Le Roy of New York, Corby of Philadelphia and Hoffman of Portland, Ore., all reported on the disease in 1920. Dubreault and Jobard of Bordeaux, France, reported a case of Vincent's infection of the finger which developed after the patient had been bitten by a man. In this case, extension of the process necessitated amputation. Cheatle, of London, reported a case of infection of the external auditory meatus. Bierotte, of Munich, reported on the frequency of the infection. Berwick, in this country, published a report on the use of the analin dyes in the treatment of mouth infections. Treleaven, of Lansing, Mich., reported on the treatment of 100 cases of the disease in 1920.

Quite a little work was done on the bacteriology of the disease during the period from 1910 to 1920. The more prominent workers in this country were Tunnicliff, Weaver, Krumwiede, Pratt and Valentine.

In 1921, Bouchet and Leroux of France published an article dealing with the relationship between the organisms of Vincent's infection and intestinal disorders. Kundratitz of Germany also published a similar article. Kline reported on the presence of Vincent's organisms in the lungs of patients who died from pulmonary gangrene. Borrello and DeAngelo, both of Naples, published articles on the infection. Bristowe, of England, reported on the drugs which tend to cause acute conditions of the oral mucous membrane. Rickord and Baker, and Aison, of this country, also reported on the disease. Plaut, at this time, described two cases of skin disease resembling noma. Buschke of Germany

reported on the increasing number of gangrenous conditions of the mouth. Gaertner, also of Germany, reported on the age incidence of Vincent's and compared it with his findings from diphtheritic cases.

In 1922, Schaaf, of Germany, reported on the use of potassium chlorate given internally as a treatment for Vincent's infection. Brody, of Springfield, Mass., published an article dealing with the influence of pulmonary tuberculosis on diseases of the mouth. Cahn published his second article on diseases of the soft tissues in 1922. Scheller and Spiegelberg, both of Germany, published articles dealing with diagnosis and bacteriology of the infection. Kielty, in this country, published an article on focal infection and included a bacteriologic study of 200 mouths.

In 1923, Stirling, Kline, Pilot, Davis, Shapiro and Morehead were the more prominent writers. Clever, of England, and Klarenbeed and Buschmann, of Germany, were among the more prominent foreign writers. Klarenbeed reported on his work in examining the oral cavities of various animals. Jelinck reported on his treatment of freezing the organisms. Knoor, of Germany, did considerable work on fusospirillary symbiosis at this time.

In 1924, Rombach, of Germany, reported on gingival tuberculosis. Barenberg and Bloomberg, Driscoll, Pilot and Davis, Sutton, Aiken, Rattner, and Vastine reported on various phases of the disease in this country. Perig, of France, published an interesting paper on the treatment from an etiologic standpoint.

The more prominent writers in this country in 1925 were Hyde, Leach, Lyons, Van Poole, Marshall, Hillsmann and Driscoll, Beckwith, Randolph and Kline and Berger. Reid, of London, contributed one of the best of the foreign papers. Van Poole's article dealt with two cases of Vincent's infection following tonsillectomy. The article by Hillsmann and Driscoll reported on the appearance of acute Vincent's infection in the mouth of a patient who was undergoing intravenous treatment for syphilis. Their conclusion was that, if such systemic treatment was indicated in the treatment of Vincent's infection, the disease would not have occurred while such therapeutic measures were being carried out.

In 1926, papers were written on every phase of the disease. Miller, Reichmann, Salman, Schroff, Golob and Hirschfield were outstanding. MacGruer and Rubenstein reported on a case of oral pemphigus with a secondary Vincent's infection. Coolidge published a paper dealing with gingival conditions and proper care of the tissues. Herzig wrote a paper advocating the use of acriviolet in the treatment of the disease. Geistfield, Rukawischinikoff, and Peiser of Germany, contributed to the literature. Peiser's paper dealt with the epidemic tendencies of the disease. Lafosse and Langle of France published a paper on the incidence of the disease.

In 1927, there was a marked increase in the number of articles published in this country on the subject of Vincent's infection. We note the tendency for investigation into broader phases of the subject. Some of the papers published in this country were by the following authors: Effler, Tischler, Tibbetts, Daley, Barrett, Reasoner and Gill, Hill, Cahan, Spray, Bloodgood, Robinson, McKay, Moore, Smith, Wack, Smith and Rusk, Ware, Mauldin, Greenbaum and Smith. The work of Reasoner and Gill dealt with the advantages of soap for therapeutic treatment of conditions of oral

sepsis, particularly in its relationship to the effect on the spirochetes of the mouth cavity. Moore's work dealt with the treatment of the disease. Casteran and Del Piano of South America published a paper on the disease. James and Evans, both of England, reported on the disease. Hentze and Herrenschwand of Germany contributed much to the literature. Moussu of France also published the results of his study.

In 1928, the foremost writers in this country were Freeman, Moore, Moriarty, Tavlin, Hardgrove, Musburger, Newgarden, Pilot, Stafne, Miner, Motta, Reaves, Kline and Whitehead. Gottlieb, of Vienna, was the outstanding foreign writer. His work reviewed the results obtained from the use of the Dunlop method of pyorrhea treatment and its application to other forms of mouth disease. Motta reported on a case of otitis media apparently resulting from invasion by the organisms of Vincent's infection. Kline's work was on pulmonary abscesses and the incidence of Vincent's organisms in the lesions. Whitehead reported on several cases of agranulocytic angina and discussed the relationship of this disease to Vincent's.

The review of the literature for 1929 is not entirely complete since we have been unable to obtain as yet all the necessary papers. Some of the more prominent writers are Winter and Hayes, Rosenthal, Hirschfield, Albray, Appleton, Disraeli and Lufkin, von Beust, Cahn, Lewis and Barenburg and Thompson. Albray's article was one of the most comprehensive. Von Beust reported on further studies of the fusiform bacillus. Thompson reported on a case of brain abscess following extraction of a tooth. Cahn demonstrated the organisms of Vincent's infection directly in the tissues. The histologic sections were taken from the gingiva of a patient who had suffered from the disease. This same thing was done by Babes in 1893. He demonstrated the organisms in sections taken from the gingivae of a patient suffering from scurvy.

In such a review as this, it is necessary that many names be omitted. Nevertheless, I feel that most of the important contributions to the literature on Vincent's infection have been included. Many published articles have been scanned which apparently were not written for the sole purpose of enlightening the dental profession. Some of these papers advocate the use of proprietary treatments and appear to have been written with the object of advancing the sales of such medicaments. Others seem to have been published for the purpose of self-advertisement of the authors. I feel that the papers here reviewed and mentioned have a more or less scientific point of view and were written with that purpose in view rather than from the standpoint of commercialism or materialism.

A FURTHER CONSIDERATION OF THE PULPLESS TOOTH

By HOWARD TEMPLE STEWART, D.D.S., New York City

The aim of modern medicine is not to mutilate but to preserve the human body.

Only recently, during the short course of one year, more than 1,000,000 tonsillectomies were performed, seemingly as a result of autosuggestive influences exerted on the practitioners, who resorted to these radical methods without proper scientific reasons.

And now our present era is concerned with the general extraction of the teeth. The term focal dental infection was formulated and already influences every medical thought and activity. The patient fears his own teeth, the physician points to the teeth, and condemns them and the dentist extracts the teeth on the least indication, all visualizing an imaginary enemy.

Should an enterologist today maintain that all infections can be traced to the intestines, so abundant with bacteria (enterogenous focal infection), he would have a far more plausible basis for discussion, a far more plausible working hypothesis than he who constructs an erroneous and harmful theory based on the presence of an apparently normal pulpless tooth. Meanwhile, no one would attempt to eliminate the highly pathogenic bacteria which are ever present in the intestines. One pulpless tooth seems to be far more dangerous.—EDWARD L. MILOSLAVICH, M.D.

MY earlier paper[1] was necessarily so condensed that much had to be omitted.

Lucien H. Arnold shows how lightly some people, particularly physicians, regard the loss of a tooth, under the assumption that it can easily be replaced artificially. In this connection, Dr. Arnold remarks that the artificial tooth is, on the average, only about 25 per cent efficient as compared with the natural tooth and that the loss of teeth seriously interferes with the oral starch-digesting mechanism.

"It is entirely unwarranted," he says, "to order the extraction of a tooth suspected of metastatic infection unless a complete physical examination excludes all other sources of infection and even then—should a tooth be *positively* proved the cause—instead of immediately ordering an extraction, effort should be directed to obliteration of the infection—which is quite as prompt and efficient and far less risky than extraction—in the hope of preserving the organs of digestion as nearly intact as possible, just as would be done with an organ in any other part of the body."

Vilray P. Blair says, "I think, without question, one can agree in the premise that the care of the devitalized tooth is the most serious and weighty problem that confronts the dentist today. I must confess to a very pessimistic view on my part as to the ultimate results of the ordinary treatment which these teeth are

1. Stewart, H. T.: Pulpless Tooth and Its Treatment, J. A. D. A., 17:381 (March) 1930.

receiving at the hands of the majority of the good dentists today."

"Without doubt," Custer says, "the most vital question before the dental profession today is, What shall we do with the pulpless tooth? The seat of the whole trouble lies at the apical foramen. The problem has been to sterilize and seal this opening in a manner acceptable to nature. Nowhere in the whole range of human endeavor has there been as much energy spent to patch up any part of a human being as at the tiny apical foramen. Is it not about time that the dentist is able to seal with a foreign material so tiny an opening as the apical foramen in a manner acceptable to nature?"

Fig. 1.—Upper cuspid with much absorption especially of the mesial surface. The line of the absorption extends mesially from the apex down about one quarter the length of the entire root. The case seemed very discouraging. This figure also shows a large copper rod which was kept in position about two months. It was removed about every two weeks for drainage. The rough edges all around the end of the foramenal wall were smoothed with a round bur (compare Figure 6, THE JOURNAL, March, 1930, p. 387), but the end of the root was, in the beginning, practically the same shape as seen in the roentgenogram.

I believe this has been accomplished. As I have tried to show, "in a manner acceptable to nature," means much, *very* much.

Rosenow writes, "It is to be hoped that an efficient method may be found that will not only render pulpless teeth and periapical tissues sterile, that have become infected, but that will also prevent subsequent infection especially of the periapical tissues. The fulfilment of the latter requirements seems almost unattainable."

I believe these requirements have been met.

To quote Hatton, Skillen and Moen: "On the other hand, if a method could be devised of getting adequate surgical drainage, if the apex has been involved, and if a method could be found which would insure a higher percentage of successfully filled canals, there would be a much higher percentage of favorable results."

Fig. 2.—Root filled. Considerable calcification will be noted. This figure was taken immediately after the filling and a denser calcification is expected to take place.

Taking the propositions in this paragraph one by one, what I have presented shows that a method has been "devised of getting adequate surgical drainage"; that a method has been found which insures "a higher percentage of successfully filled canals" and that there is "a much higher percentage of favorable results."

A clean record of more than 300 cases (everyone where the foramen could be successfully opened) extending over a period of more than four years, with

most pleasing clinical results, speaks for itself.

Hudson extracted pulps and filled roots "to the apex" with gold in 1809, 120 years ago.

In 1888 (forty-two years ago), James Truman said, "We are as far from a settled policy in the treatment of the pulpless tooth as we were forty years ago." At that time (eighty-two years ago), guttapercha was the chief material used. It was the chief material used when Truman spoke: it is the chief material used today, and so I think it could be said that we are no nearer a settled policy than the profession was eighty-two years ago.

Dr. Sudduth wrote, in 1888, "The

Fig. 3.—Glass tube that has been immersed in methylene blue for more than two years. Various sizes of tubes have been filled and tested in every conceivable way, even under pressure of a column of water, but there has never been the slightest leakage. This test can be very easily made by anyone who wishes to satisfy himself. Filling glass tubes is an excellent way to watch the working of the filling while the material is being placed in position. Small glass tubes of various diameters may be used to represent the canal of the tooth root.

main office of the pulp is formative, and all the 'live' portion of the dentine is a part of the pulp; the dentinal fibrils are prolongations of the pulp and when the latter is destroyed they die also. There is no other tissue in the dentine to nourish, hence no need of nourishment after the death of the pulp. The function of a tooth is to serve the purpose of mastication, and as after it is fully developed it will be retained in its place by the pericementum and will serve the office of mastication quite as well as when its pulp was alive, provided the root-canal has been properly filled, therefore I see no harm in devitalizing the pulp if necessary."

How like the discussions of forty years ago are those of today. In 1889, at the meeting of the American Dental Association, we find almost exactly reproduced the same thoughts and the same words in regard to the pulpless tooth. J. D. Patterson, of Kansas City, said, "I think the subject of root canal filling the most important before the profession today." James Truman said, "A great deal of talk on root canal filling seems to be based on guess work . . . no filling in a tooth root can be perfect because the largest part of the tooth is a tubulated structure; these tubules hold organic material and when the pulp dies, this organic structure dies and decomposition takes place at once, sulphuretted hydrogen being evolved to become a source of trouble; in filling a root an account must be taken of the contents of the tubuli; chloride of zinc is the best agent to use to prevent decomposition because of its affinity for moisture; it will follow to the extremities of the tubuli, change the character of their contents and prevent their decomposition. A tooth treated with chloride of zinc will probably not discolor and at all events there will be no trouble in the roots. The use of chloride of zinc requires much care; if carried through the foramen it causes inflammation." He fills the upper end of the canal, then places cotton, saturated with chloride of zinc, in the cavity for two or three days. He believes oxy-

chloride of zinc is the best material with which to fill the remainder of the canal because it will keep up the effect that he desires to secure. To quote Dr. McKellops: "No man can go to the end of some roots with any security of following the canal . . . filled canals with chloropercha," and so on. Jonathan Taft, of Cincinnati, said, "The term 'apical space' is misleading, apical region or apical territory is more applicable." W. H. Dwinelle, of New York, said, "If the foramen is sealed, it makes little difference what material is used for the rest of the filling." He has seen teeth whose roots he filled nearly or quite fifty years before (ninety years back from the present time). Think of it! He used gold for the filling of the roots. He said, "These teeth now verify my theory and justify my operations." W. W. Allport, of Chicago, in root filling, wants to know, not only how he does it, but why. When the pulp is removed, the principal source of nourishment of the tooth is taken away and the tubules are left filled with organic matter to decompose and generate gas. You may fill the canal as perfectly as you please and these gases will percolate through the cementum and cause irritation of the pericementum. To get rid of the contents of the tubuli, he uses hot air, following that with an antiseptic and filling with oxychlorid of zinc, which, he says, "will prevent further decomposition." "More trouble comes from not clearing out the débris thoroughly and not filling perfectly than from any escharotic effects of materials forced through the foramen." He did not know that there was any necessity for filling the canal perfectly if the canal was first thoroughly treated but that it was safe to do so and might not be safe not to do so. Dr. Dwinelle said further: "If the fibres of the tubuli are coagulated,

Fig. 4.—Copper rods in position. Above, right: Copper rod in a bicuspid which had been pulpless for many years. The roots of the adjoining first molar have been filled about one year. This tooth also had been pulpless many years. The bicuspid has just been opened and the rod inserted.

they become inert and do not throw off gases." After the age of 40 or 50, he does not consider the pulp essential to the tooth.

Here, I quote from a writer whose name I have lost. In speaking of the way that these earlier practitioners treated pulpless teeth, he says, "Such procedures have been the cause of saving thousands of teeth which, owing to the lack of dental knowledge at the time these gentlemen were trained, might otherwise have been lost."

who assume a knowledge they do not possess, and sagely counsel what to do and what not to do with the pulpless tooth.

In "Clinical Periodontia," by Stillman and McCall, we find the following; "When shall a given pulpless tooth be extracted or when may it be safely treated and retained in the mouth?" For the guidance of those wishing to know when to extract or retain, they say the conditions required to be considered are as follows:

This table means, if it means anything,

	When to	
	Treat	Extract
General health	Good	Below normal
History (personal and family)	Freedom from debilitating disease	Susceptibility to disease
Age	Below fifty	Above fifty
Blood (factors concerned in resistance)	Normal constituents and cell count	Abnormal constituents and cell count
Site of secondary infection	Tissue of high regenerative power, as muscle	Tissue of low regenerative power, as eyes, ear, nervous system
History of tooth	Periapical disease absent or of recent inception	Prolonged periapical disturbance
Radiographic findings	Little or not periapical or periodontal derangement	Appreciable periapical or parietal bone alteration
Field of operation	Accessible.	Inaccessible

I wish that I had the time and space to review dental literature in general and especially such literature as culminated in the paper of Lucas in the *Dental Cosmos,* June, 1928; literature that is the result of much labor and ability and that compels us to think, even though we draw conclusions (which we do) absolutely opposite to those of these men.

Then, besides these experimenters and research workers who have really done something worth while and who make us think, we have another class of writers

that we are to follow the directions contained therein before we decide to extract or treat a tooth. For instance, if the patient or the patient's family show susceptibility to disease, we must extract.

Just look those conditions over carefully and see how accurately the average reader could form an opinion on the question of treating or extracting teeth. If one wished to, there is an excellent opportunity to hold the entire statement up to ridicule, and that might be an excellent way to dispose of it, but this would

not be altogether consonant with a scientific discussion.

Let us see what the *London Lancet* says in reviewing "Clinical Periodontia": "Many strange words indeed appear in this book . . . we deplore this invention of new and unnecessary words when others exist with the sanction of long usage—it darkens counsel and may, as Voltaire reminds us, conceal a poverty of thought." And, to those who do take such writings seriously and who do not discern the "poverty of thought," it does much harm.

The same authors tell us, "Fortunately we have at hand a means of determining with accuracy the presence of focal infection in the system, whether the patient is

Fig. 5.—Film showing shape of canal.

visibly ill or in apparent health." The world is still waiting to learn how this is done. Also, "We now find that periodontal disease, both periapical and parietal, is the cause and not the result of the uric acid." The *Lancet* must be right: To quote from the authors of "Clinical Periodontia," "The findings of blood chemistry make it possible to determine whether we are justified in treating a pulpless tooth. . . . It also will corroborate the evidence of the radiograph as to the existence of infection in the maxillary structures." If you don't believe this, Alice, just shut your eyes and try hard. "The best subject for pulp canal treatment, if any, is the young patient of good health and good personal and family physical history." And again ". . . stimulating a deposit of secondary cementum to close the apical foramina holds the only real promise which we can at present see for the continuation of root canal work." A bright outlook for the pulpless tooth!

Again quoting from these authors in reference to the many diseases caused by the pulpless tooth: "These points have been arrived at through experience and study of many cases of metastatic disease and have been corroborated by careful investigators." We wish they had told what this "experience and study" was and what the "many cases of metastatic diseases" were that were caused by the teeth and how they knew the cause; and who the "careful investigators" were and how they corroborated "these points."

Such literature is very dangerous. Men generally reading statements, by supposed authorities, believe them, are discouraged and cease practical effort. "Such labored nothings in so strange a style, amaze the unlearned—and make the learned smile"; but the tragedy is that so many are amazed.

Referring to blood tests, Hatton says, "A recent careful examination of more than a hundred individuals by Mueller in our laboratory failed to prove the value of this test. It is true that there is an increase in the blood uric acid content in a certain proportion of chronic infections, but it is uncertain, even more so than the blood cell counts. An increase seems to be much more significant of lessened secretion because of some kidney defect; in other words, retention is suggestive of some degree of nephritis rather than of focal infection."

Miller, a recognized authority on blood chemistry, speaking of "the destruc-

tive effects that the so-called focal infection theory has left in its wake," says, "In an article in the *Dental Cosmos* in 1921, I called attention to some of the utterly absurd tests and ridiculous interpretations thereof which over-zealous dentists are employing as the final criteria of the need, or otherwise, of extractions." And yet, McCall says, "Blood chemistry will tell us whether or not to extract a pulpless tooth."

The question has been raised as to whether I think that men generally can open the canals as shown in my illustrations. I do think so. A little more than four years ago, when I began this work in earnest, I could not open canals. It was only after conceiving the idea of drainage that I began to open the foramen without fear, and then I found how certainly and surely the average canal could be opened and so I know that men generally can open them. Had I been asked, *Will* men generally do it? I would not know how to answer. That is the question, but they *can* do it just as well as I, if they will.

If dentists would open and fill fifty canals of extracted teeth during the next thirty days and then go to work in the mouth to first test out the treatment of the pulpless tooth, before extracting, I believe this would constitute "the next great step in preventive medicine." It would make a far more professional profession of dentistry, and be of immeasurable benefit to health and greatly increase longevity. I seem to have been understood by some to imply that the old methods were failures. I meant to convey no such impression, but I do believe that my method will free more teeth from infection (and keep them free) than the old methods. The old methods, if carefully, skilfully and thoroughly used, are usually successful, but usually they were not thus used, except by a very few men.

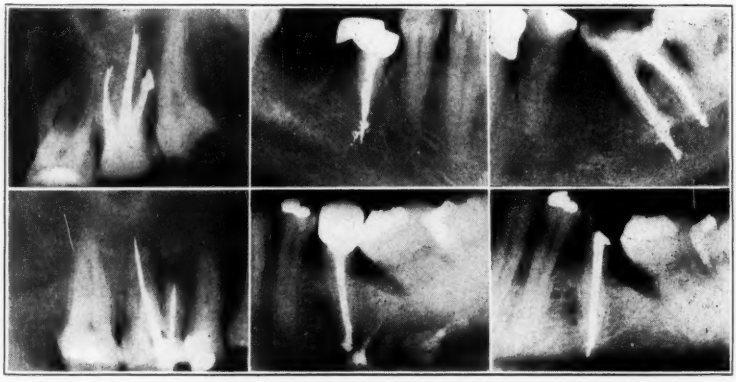

Fig. 6.—Miscellaneous films which, if studied closely, show the usual shaping of canals.

Hatton, Skillen and Moen say, "The three most frequent failures in root canal filling are: 1. Failure to remove all of the pulp tissue. 2. Failure to fill the full length of the pulp canal. 3. Failure to fill the full diameter of the canal." Grove gives us the situation in a nutshell: "The most important part of the root canal operation is hermetic sealing of the apical portion of the canal." Hatton, Skillen and Moen continue: "On the whole, the

presence of these (small accessory) canals, especially in the apical third, does not interfere with regeneration. Infection in the small canals is extremely rare. We do not remember any instance in our specimens. On the contrary, it is the large canals that become infected, and it is through them that the apical space becomes involved.

"Our specimens all direct attention to another type of incomplete filling that is not revealed by the roentgenogram and which I believe is more important; namely, the incomplete occupation of the full diameter of the canal by the filling material. We have mentioned this type of incomplete filling repeatedly and stressed its importance in the production of failures in treatment." At this point, I wish especially to emphasize the ease and certainty with which "the incomplete filling of the full diameter of the canal" is overcome and how it is no longer a factor of "importance in the production of failures in treatment" when the canal is properly enlarged and filled with the gold-tin-mercury mix. To test, simply fill a glass tube and immerse in dye. This type of incomplete filling, they say, is so common as to be present in more than three-fourths of the teeth that we have examined. Indeed, the examination of root-filled teeth breeds anything but respect for the average practitioner's technic." The foregoing is all very valuable information and encouraging, but discouraging and almost hopeless is the following: "Pulp canal treatment is at best a difficult operation, and if not to be well done, should not be attempted, but any reasonable modification of its technic in the direction of simplifying it should be welcome.

"In other words, while we do not desire to endorse pulpectomy or pulp amputation at the level of the floor of the pulp chamber as a routine procedure, neither do we wish to condemn a method of filling root canals that does not bring the apical end of the filling to the junction of the cementum and dentine at the apex. The selection of the level at which to end the filling is, we believe, a problem of accessibility." Think of this for definite advice—it gets us nowhere—advises nothing—we know not a thing! See the utter confusion into which this throws us, and yet my heart goes out to these men for the exceedingly careful and intelligent study they have given these things. They could draw no other reasonable conclusion—they could give no other conscientious advice—after their numerous examinations of pulp canal work as usually done. They report that out of 500 treated extracted teeth examined, only one perfectly answered their requirements.

One great advantage of my method is that it would be difficult to use it at all unless it were done thoroughly. If the canal is enlarged and the foramen opened, the canal is bound to be clean. The filling material (gold, tin and mercury) is then so easily inserted that it would be rather difficult not to fill "the full diameter of the canal" and to "seal the foramen." Consequently, if this method were generally adopted, there could not possibly be the same conditions that now cause the treated pulpless tooth to be condemned. Kells said, "A perfect root filling is an accident." We can now, I believe, say that an imperfect root filling is an accident, provided the canal has been properly prepared. Another point that I wish to make clear: Even if the foramen is not enlarged for drainage, I believe that the gold and tin amalgam more certainly fills and seals the canal than any other material that has been used; but remember that the canal itself

must be well enlarged to be perfectly filled with *any* material. Moffitt's preparation[2] is worthy the most careful study, enlightening and constructive. If you are skilful enough to abstract the contents of the canal in a favorable case without carrying so much débris and infectious matter through the foramen that Nature cannot take care of it, and object to going through the foramen, then by all means do this rather than extract the tooth; and, if well done, favorable cases should be attended with success, but I believe it unwise not to give thorough drainage to a tooth where the apical tissues are clearly infected.

To quote Hatton, Skillen and Moen again: "It would seem that if the tissues at the apex are diseased to the extent that instrumentation or drugging with caustic substances within the apical space seems necessary, such teeth should not be treated." What a commentary! That would condemn by far the majority of the teeth I have treated, the results of which, I believe, reverse the statement that "such teeth should not be treated." To open wide the foramen, to drain these "diseased tissues at the apex," thus getting bone regeneration, and then to fill with a perfectly tolerated plastic metal filling that does fill the full diameter of the canal, and that does permanently seal the foramen, and to obtain consistently a satisfactory clinical result — all this entirely justifies us in rewriting their statement—such teeth should be treated.

Remember, these men had in mind no surgical drainage of these tissues and no successful filling of a large open foramen. They knew, of course, of no filling that could be used successfully in these cases. The material that goes into the apical space is extremely soft and plastic and remains so. The very movement of the tooth in mastication would tend to make it even more so. The material in the apical space must be permanently plastic because the slight movement of the tooth in mastication would cause a hard or sharp edge or rough substance to irritate the tissue constantly and also because tissue changes should be able to displace the material in the apical space.

More than 300 roots (all those that I was able to open through the foramen) have been successfully filled clinically, and about 90 per cent were teeth long "dead" and, of course, infected, so that "the tissues at the apex were diseased to the extent that instrumentation or drugging with caustic substances within the apical space seemed necessary." In other words, they come in that class in which even the man advocating root canal treatment usually advised extraction. Teeth with freshly extracted pulps are a very small proportion of those seen by us. Few adult patients come to us who have no pulpless teeth, and very few, in comparison, with live pulps to be extracted; and so the method that deals only with teeth having the pulp freshly extracted, renders a comparatively small service indeed.

The point is this: If the source of infection is entirely eradicated, the apical space will often recover from both the previous infection and the presence of the débris carried through by you. Of course, the freshly extracted pulp case is different; but Coolidge says, "Records covering a period of more than twelve years reveal a larger percentage of successful canal fillings of roots that were pulpless than of those from which vital pulps were removed." Again: if you do not go to the end and do not force any débris through, the tissues will often take

2. Moffitt, J. J.: Root Canal Treatment Preparatory to Crown and Bridge Attachment, J. A. D. A., 15:1480 (Aug.) 1928.

care of the small amount of substance left in the end of the root; in fact, sometimes Nature has already walled it off. And again she does none of these things. And, if this is not enough, consider the possible accessory foramina; then, too, the possible slight denudation of the apex. It becomes kaleidoscopic—we are thrown into confusion. And so, is it not the safest thing in all cases to open the canal thoroughly and establish drainage?

My advice to those really in earnest is to experiment with extracted teeth—say, fifty teeth. Complete two a day—the fifty can be done within a month. This will open the way for success in the mouth. Do not select the teeth—take them indiscriminately—single rooted and multirooted. You will probably be astonished at how little you know; at least, *I* was. You will (as I did) probably find that it is not best to confine yourself to any one shape or kind of instrument, but to use anything the situation suggests, drills (hand and engine), broaches, files, picks, explorers—anything that will explore, penetrate, enlarge or clean. These will be suggested more readily by operating on extracted teeth than on teeth in the mouth.

In your own office, treat yourself to a four weeks' post-graduate course with fifty extracted teeth and all the instruments (hand and engine) you know of for opening root canals. You will have a good time and it will cost very little. Do not try to economize on instruments—all you can think of will cost you only a few dollars. Each dentist should try out the instruments to see which ones can best be used by the individual. Barbed broaches, smooth broaches, root canal files, picks, drills, root canal reamers, and so on. Now, suppose we take an ordinary extracted pulpless tooth, pulpless from whatever cause and maybe for one year, maybe ten. You know how many of these "flare up" on being opened. An entrance even into the pulp chamber with an ordinary bur may cause just enough pressure to force a little of the fluid matter in the canal through the foramen, so go carefully. Place equal parts of solution of formaldehyd (formalin) and a saturated solution of zinc chlorid in the pulp chamber. Even this pellet of cotton pressed in by pliers may force a little septic fluid through the foramen. I sometimes keep this in place only an hour or two, then open the canal freely, foramen and all. Usually, this is kept in place twenty-four hours.

After the pulp chamber is cleaned, and the mouths of the canals are exposed, we first carry a small quantity of full strength hydrochloric acid (on any suitable instrument) into the mouth of the canal, and work this gently down with finest size barbed broach. Not only does the acid help to open the canal, but also experience teaches me that it is the best surface sterilizer. Besides, it unites with and partially dissolves the minute shavings of dentin as the broach or file cuts them off the wall. Then, when some of this débris (as is inevitable if the canal is cleaned) is carried through the foramen, the acid renders it inert and fluid so it can readily be washed out of the periapical space. When at the one sitting the canal and foramen are thoroughly opened in this way for drainage, I have yet to have one of those cases of acute abscess swelling and all the unbearable symptoms with which we are so familiar. True, there is sometimes pain (very seldom, however), but this pain is usually very slight as compared with the distressing agony of the usual acute abscess. This is due, of course, to the free drainage.

Lucien Arnold speaks of hydrochloric acid in the periapical space as being of benefit and no harm and states that it combines with sulphur, generating hydrogen sulphid, and the products left are chlorids which are normal to the body. Sulphuric acid produces sulphates and these are taken care of with more difficulty. My own clinical results with hydrochloric acid coincide with Arnold's. While using instruments in the canal, to open and enlarge it (in extracted teeth), we should watch carefully the débris that goes through the foramen. This will convince one that the canal cannot be cleaned to the end without carrying débris through it, and when it is through, even if the canal is filled perfectly to the end, septic matter is simply sealed up in the periapical tissues. True, this wonderful tissue often encysts or entirely digests such matter, but what a chance to take! How much better it is to get it out as a surgeon would extraneous matter before closing a wound. Remember that a small canal and a small opening is no guarantee against matter being carried through, but this matter cannot possibly get out again. The foramen must be enlarged freely to permit this. Then, the cotton points, the spray, the syringe, can all be used with effect, but not so with the small foramen. Peroxid can be freely used with no fear of back-lash, and the excretions readily exude into the canal and are harmless. I like to leave the canals free and open between sittings, stopping the pulp chambers only. This allows the accumulating secretions to overflow into the canal and prevents pressure.

It seems that we have been managing these cases as unlike surgery as it was possible to do. Drainage is the surgeon's watchword, his first and greatest commandment. If there is infection, he opens the tissue and keeps it open. Ochsner, in "General Surgery," says: "1. Infected bone cavities should heal from the bottom. 2. The soft tissues should be kept wide open. 3. No antiseptics should be used, only drainage, but whatever may be used in this bone cavity should stimulate excretion from tissues, and do this only." What do we do? We simply attempt to clean out the drainage tube, and do not half do that. Besides, we carefully avoid cleaning it at the end that projects into the infected tissue for fear of wounding that tissue and then we place antiseptics in the drainage tube and write learnedly on the asepsis and bacteriology of our drainage tube. Could anything be more childish? Is it any wonder the surgeons had no confidence in anything we said about the pulpless tooth? Let me not be misunderstood—thousands of cases have recovered (even when the periapical tissue was infected) simply by removal of the contents of the canal, and filling, this extraordinary tissue taking care of the infection as would not be done in any other bones in the body. And here we have the quarrel with the average "biologist" and "research worker." Their efforts so often are bent to prove the contrary: that the tissue is low in recuperative power when once wounded or infected as is true of the dental pulp. Every organism they find is there to doom the tooth and produce all the diseases in the category. And, much as I regret to say it, some otherwise honest writers are presuming on the general lack of intimate histologic and bacteriologic knowledge to frighten dentists into extracting teeth. We must remember too that these laboratory men are just as conversant with all the details of the clinical results in the mouth as we are conversant with their details in the laboratory; that they know just as much as to how our methods differ from each other as we

know how their methods differ from each other; and they know just as much as to how each operator can change and adapt his methods to produce a favorable and physiologic result as we know how each laboratory man can adapt and change his methods to produce an unfavorable result.

We have too long made our clinical judgment subservient to the expressed opinion of the laboratory man, while the laboratory man, on the whole, has done (largely unconsciously to himself) a most elaborate amount of work in order to draw the conclusion that all clinical results have no weight and are utterly worthless. One would think that the roentgen-ray was only a delusion and a snare; that the evidence of regeneration of bone around the apex of a tooth was an actual indication of disease and was different from regeneration of any other bone; that freedom from tenderness or inflammation or any unfavorable clinical results were only an indication of the utter depravity of these tissues, which are only lying in wait and covertly hiding every symptom (unlike other tissues in the body) in order to produce every disease in the category for which no other cause can be found.

Let me not be misunderstood. Histologic and microscopic work are, of course, invaluable and will finally coincide with and prove our clinical results just as much as it has proved the surgeons' clinical results, while the average laboratory worker gives us the impression that his mission in life is to disprove clinical results.

After the foramen is opened, it often clogs and needs to be cleared at each sitting. This is usually done by cotton canal points carried up with the pliers. Sometimes, metal rods are kept in place for this purpose. Here, I shall refer briefly to the use of copper rods, which I often use, not only to keep the foramen open but also to stimulate drainage. I hesitate to refer to this now because my experiments have not extended over a sufficient time to give out definite information at present, and I mention it only that others may experiment with them. Of course, it is too early to express a decided opinion, but copper seems to (1) stimulate secretion; (2) cause a breaking down of diseased tissue; (3) cause aseptic suppuration; (4) stimulate tissue regeneration, especially of bone, and (5) stimulate the flow of lymph. Figure 4 shows copper rods in place.

Experiments of Lange of Germany and Zierold of Minneapolis show definite stimulation of bone production by copper. While causing aseptic suppuration of tissue immeditely adjacent, it causes a reproduction at a distance. Experiments with metals in culture mediums by Charles Leedham-Green (surgeon to the Queen's and Children's Hospitals, Birmingham, England) show that "by far the most powerful of the metals bactericidally proved to be copper, and, in a less degree (according to the percentage of copper used in their composition), its alloys, bronze and brass." As far as I know, no one has ever used the copper for the purpose of producing suppuration or stimulation of bone production. It has been used only to ascertain its tolerance or intolerance (along with other metals) when implanted in normal healthy tissues. It occurred to me that if it did produce the aseptic suppuration of the tissues with which it came into immediate contact; if it powerfully stimulated the reformation of tissue in the region adjacent to the suppuration, and if, in addition, it was germicidal, it might be of use in breaking down granulation tissue and stimulating regeneration about the root

in addition to keeping the entire field sterile.

To return to the canal opening: After removing as much of the canal contents as we can with barbed broaches, a No. 1 file is used. Usually, each file or broach should be used, not only until the entire canal is penetrated by it, but until it works loosely, although often we have to enlarge the first part of the canal and later the apex. It is well to curve the file slightly after it works loosely, as it will then bind and cut more. This better prepares the way for the next one. Nearly always, the entire six files are used. There are few canals which I do not enlarge considerably with drills after the No. 6 file is used. I often begin with drills after the No. 4 file.

Sometimes, it is argued that such work can be done in a large city but not in small towns, that people will not pay for the time. This is a mistaken argument. The city man is more pushed for time. He has less time and inclination to explain details and carry his patient along with him. He has greater expense and is tempted to be more commercial, and less human. I know a man in a big city who pays $300 a month for his office. He paid $35 a month in the village before moving to the city. Is it not because he does not want to do this work that the average dentist reasons thus? I am not censuring, just stating facts.

Suppose we explain to the patient that if the tooth is extracted the two adjoining teeth will have to be mutilated, with almost certain discomfort and tenderness or grave danger of dying of pulps in the future, if replaced by the large inlay system of "movable-removable" bridges, and so forth. Suppose we explain further the danger of breakage and the annoyance of having to remove and replace the bridge two or three times daily (imagine four permanent molars so replaced), or the danger of deterioration from clasps (to say nothing of their looks) and the possible injury to the gums or peridental membrane; the effect on facial expression from the loss of the roots of the teeth, besides the initial cost of making the immediate bridge with a possible larger bridge sometime in the future; to say nothing of the pain and shock to the nervous system, and the mental effect on the patient of the whole thing. How many right-minded, intelligent patients do you think, would agree to the extraction? How many would refuse to pay as much for saving the tooth as for making the bridge? But, you say, suppose that, after you treat the root, you still have to extract it? That, of course, is well worth considering and depends entirely on how you treat it.

Here, I will say, we are not developing finger skill, that great requisite of successful dentistry, as we used to. Our fathers were much better prepared in this respect than we, and in some ways practiced much better dentistry. When my father began dentistry, we had few dental engines. When I began to work in his office as a boy, he compelled me to do all my first work with my fingers. Incidentally, if the colleges do not get back to finger training, dentistry will still further deteriorate and we will have a continual flood of literature on becoming an M.D. instead of a dentist, and furthermore men will stay M.D.'s instead of becoming dentists. Here, I cannot forbear quoting from Sir John Tomes: "It has been strongly urged that dental should become supplemental to medical knowledge; that the practitioner should be a doctor first, and a dentist afterwards. This opinion might perhaps be sustained if the position were reversed—a dentist first and a doctor afterwards, provided

all or even a majority of students were sufficiently rich in money and time to extend the educational period from four to six years." And may I add, provided the 90 per cent of our population who are not receiving efficient dental service were so supplied.

In my former article, the preparation of the filling material seems not to have been made clear to some. Simply mix gold foil and tin foil with mercury to a soft plastic mix. Glass tubes will demonstrate the easy working qualities of the material.

A writer in the *Dental Digest* says that no one can put in a perfect root filling, that no one ever did or ever will fill and seal an apical foramen because, he says, it cannot be dried. "If you doubt this," he continues, "place a root end on wet cotton or spunk—the foramen will again fill as fast as you absorb the moisture." If the writer referred to will take the gold, tin and mercury mix and fill a glass tube (the tube standing on wet cotton—even first filling the tube with water), he will see the metal gradually drive the water out of the tube. This tube, afterwards immersed in dye, will not leak.

Another thing that I find was not clear to many readers is the use of the round bur. The picture of the two burs through the foramen of a molar tooth, Figure 6, in a former paper, gave the idea to some that I enlarged the canal with these burs. The canal is enlarged with ordinary nerve canal drills and the burs are used only to enlarge the foramen at the apex of the root, making it funnel-shaped. This is done only in case of suspected denudation of the end of the root, and when the canal has been enlarged, a round bur, the size of the canal, is then selected and passed through the foramen, then pressed to the side so as to hook the bur over the foramenal wall. The engine is not started until this bur is placed in position, then, by pulling downward, the end of the root can be entirely amputated, if desired. In this way, it is to be especially noted that no dentin is left exposed as in the usual amputation of the apex. All of the dentin is left protected by the cementum so that when the canal is filled, no dentin is exposed to body fluids. This is a most important point. This operation is much more conservative of root end structure than the usual amputation, and it is my opinion that it is usually necessary to sacrifice only a small proportion of the apex as compared to what is usually sacrificed in apicoectomy. In other words, there is usually nothing like so much denudation of the end of the root as we have been led to believe. In most cases, even of long standing infection, the mere enlargement of the canal through the foramen is entirely sufficient to take care of the denuded area without the use of the round bur at all. As was pointed out in my former paper, even if a slight denuded surface is left, the filling material spreads over it and the tissues growing down against the material press it down from every side against this denuded surface.

It has been urged that the filling material may discolor the crown of the tooth. This is briefly answered by saying that it is not necessary to fill the entire canal. The apical one-half or one-quarter (if a crown post is to be used) may be filled with this material and the remainder with any suitable material. My own preference is to fill down nearly to the pulp chambers with cotton saturated with zinc chlorid (saturated solution), and then to finish with oxychlorid of zinc.

This small amount of oxychlorid is easily drilled through, in case the canal is to be reopened. In a nutshell: It is

necessary only to definitely and safely seal the apical foramen.

The question has been asked in many letters as to how long a dressing is to remain in the canal. This often depends on the secretion of the tissues. Usually, the second dressing is kept in from two to four days and the following ones governed by the indications, sometimes from two to four weeks. The time of filling is governed by the secretions and clinical indications much as in the closing of wounds in general surgery.

I realize the lack of detail of consecutive operative procedure in this and the preceding paper. I hope soon to give to the profession a paper dealing with this alone.

CONCLUSION

1. This method accurately and easily fills the full length and full diameter of the canal.

2. It definitely and with certainty seals the foramen.

3. The surplus beyond the end of the canal is surprisingly mobile and plastic and remains so, and thus it is nonirritating to the tissues while the tooth is in the movement in mastication. This also allows the tissues to grow in over the end of the root or to press the material against a denuded area.

4. The material is impermeable to fluids, will displace moisture in the canal and will not leak.

5. Actual and definite surgical drainage is obtained.

6. The tissue is given a chance to rid itself of infection and to heal as do other tissues in surgical operations. This tissue has been the abused and despised stepchild of the human body. Let us give it a chance.

7. If the profession would earnestly and sincerely give this method the most thorough and exacting test, I should await the results with the utmost confidence.

ODONTOMAS: CLASSIFICATION, DIAGNOSIS AND TREATMENT*

By L. W. SCHULTZ, B.S., D.D.S., M.D., Chicago, Ill.

THE term "odontoma" was coined by Broca in 1869.[1] And the anatomic society which met in Basle, Switzerland, in 1895, to devise a uniform scientific medical nomenclature, accepted it. Hence, it should be a satisfactory term. It is of Greek derivation, from *odous-odontos,* meaning tooth, and *oma-omatos,* a tumor.

However, judging by the numerous classifications which have appeared in the literature, it would seem that this expression is not sufficiently restricted. The term permits inclusion of all new growths arising from the dental system, be they hard or soft. Among other authorities, Moorehead and Dewey[2] restrict this term to hard tumors of the jaw composed of

*Read before the Odontographic Society of Chicago, Oct. 21, 1929.

1. Broca, P.: Traité des tumeurs, Paris, 1869, Vol. 2, p. 275.

2. Moorehead, F. B., and Dewey, Kaethe W.: Pathology of the Mouth, Philadelphia: W. B. Saunders Company, 1925, p. 483.

Fig. 1.—Extensive odontoma at the angle of the mandible.

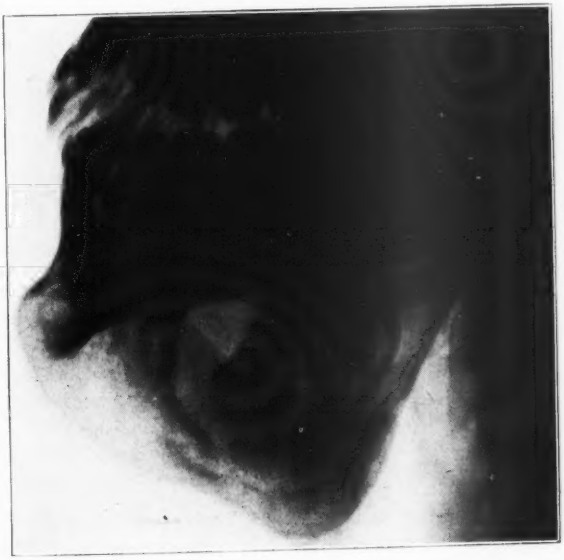

Fig. 2.—Cavity in the mandible immediately after removal of the tumor.

fully developed enamel, dentin and cementum, a point of view which I have adopted.

Bland-Sutton's[3] classification, while still in common use, I feel is not so accurate as it should be, since it includes cysts and cystic masses. Thus, it includes follicular odontomes or dentigerous cysts, compound follicular odontomes which are also cysts, but which contain a number of teeth or denticles, multilocular cysts, etc.

The most complicated and complex classification appears in Hopewell-Smith's textbook.[4] I shall not trouble you with a recitation of that classification. But I must mention two more classifications for the sake of completeness. The first one, that of Perthes,[5] is brief. He divides these tumors into two groups, namely, simple odontomas, comprising both the free and the adherent varieties, and composite odontomes. In contradistinction to this classification appears the work done in 1914 by a special committee of the British Dental Association and published by them in book form under the title "The Report on Odontomes."[6] Their classification, a lengthy one, probably includes all possible forms of these tumors, which are described exhaustively and profusely illustrated.

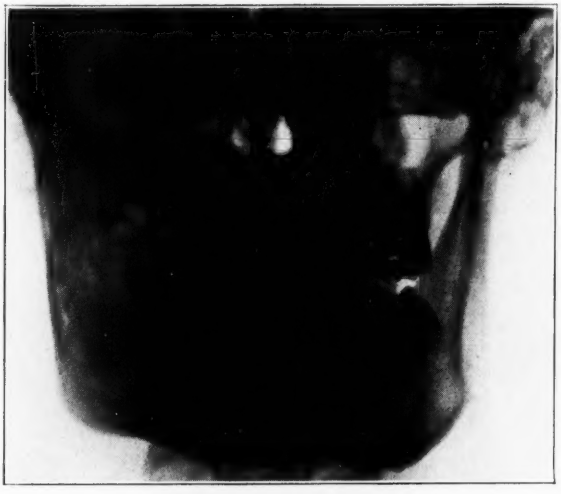

Fig. 3.—Appearance of jaws, showing difference in width of the normal side and the side operated on.

A diagnosis of odontoma offers no difficulties to the practitioner who is thorough in his methods of examination. A good history should always be obtained, all the aids to a correct diagnosis should

3. Bland-Sutton, J.: Odontomes, Odontol. Soc. Great Britain, Nov. 18, 1887.

4. Hopewell-Smith, Arthur: Normal and Pathological Histology of the Mouth, Philadelphia: P. Blakiston's Son and Co., 1918, Vol. 2, 206.

5. Perthes, G.: Die Verletzungen und Krankheiten der Kiefer, Stuttgart: 1907.

6. Gabell, James and Payne: Report on Odontomes, British Dental Association, 1914.

be invoked and especially should a well focused roentgenogram showing good detail not be overlooked. Such a shadow picture would focus the attention of a mere tyro on the presence within or about the jaw of an unusual mass of limited extent, with or without a capsule and with great variations in radiolucency or radiopacity. The mass may be connected with an erupted or unerupted tooth and in it toothlike bodies may be recognized. Now, if such a roentgenogram is obtained from a young person either during or shortly after the period of second dentition; if a tooth or teeth, which should be present in the arch at the site of the tumor, are missing and there is no record of a related extraction; if the patient exhibits an enlargement which has been slow in growth and usually painless, the indications for the diagnosis of odontoma are plain and conclusive.

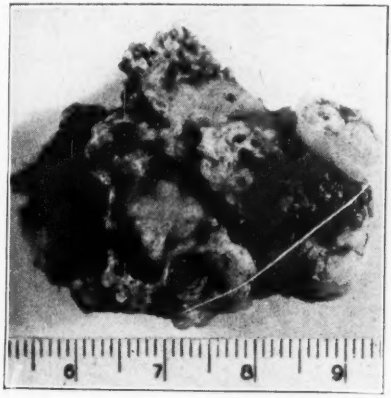

Fig. 4.—Tumor. Arrow points to dense portion overlying imperfect crown of molar.

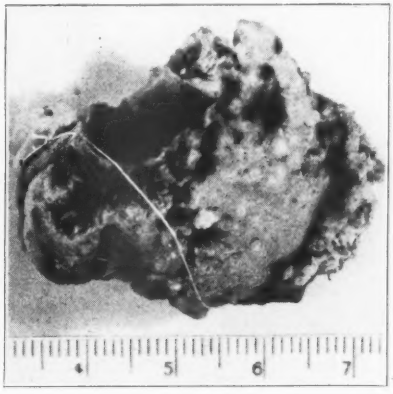

Fig. 5.—Lingual surface of tumor.

Yet, even in so plain a condition as this, men will fail and fail wofully, as I shall show in the following report. But before proceeding with the case report, I shall finish this discussion on odontomas, including their treatment.

Briefly, treatment consists in complete enucleation. The entire tumor must be ablated and, if encapsulated, the capsule must be removed. If it is physically possible to shell out the mass with the capsule intact, I prefer that method, for it precludes what tendency to recurrence there may be in some forms. If unable to accomplish this, I spare neither time nor pains in the effort to remove every vestige of abnormal tissue. Small cavities are immediately closed and union by first intention is usually obtained. Large cavities are left open and encouraged to heal by granulation. In all cases, the normal contour of the bone is restored as far as possible by molding.

Report of the case alluded to above will illustrate some of the points I have attempted to make:

History.—J. L., a boy, aged 19 years, presented the following history, Aug. 10, 1929: Two years ago, he consulted a physician with reference to a slowly growing, progressive enlargement of the left mandible in the molar region. This physician called a colleague in consultation and, between them, they decided

that he had a cyst which must be operated on. A large cavity was made in the body of the jaw just anterior to the ramus and packed. This postoperative packing was kept up for two years or, to be exact, up to three weeks before he saw me. Then, they proposed to extract the two molar teeth in front of the cavity and curet the latter. The patient became alarmed and, mentioning his fear to his dentist, was referred to me.

Examination.—There was a pronounced enlargement of the left side of the face in the region of the mandibular angle. The soft tissues of the cheek were normal, the enlargement of the mandible causing the entire deformity. There was a large opening at

Fig. 6.—Third molar in occlusion. The cavity made by the previous operator can be seen.

the site of the old operation, and the cervical lymph glands were enlarged. The lingual border of the opening was formed by what resembled a sequestrum. Pus was absent, but this could be due to the patient's rinsing his mouth just before coming in. The exposed bone itself neither looked nor felt like a sequestrum. It was too dark and of too smooth a surface, yet it looked like denuded bone. Anteriorly from this was the third molar, occluding with its opponent. A slight space separated this third molar from the first molar. The second molar was missing in an otherwise exceptionally nice set of teeth. Hence, what had been proposed to him was the removal of the first and third molars and a curettage of the 2-year-old cavity; this as stated before, by two physicians, one of whom professed to be specializing in oral surgery. A roentgenogram taken at this time is shown in Figure 1. I do not think that anyone can fail to see the large tumor mass in the mandible, noting the difference in the shadows cast in various places. The rela-

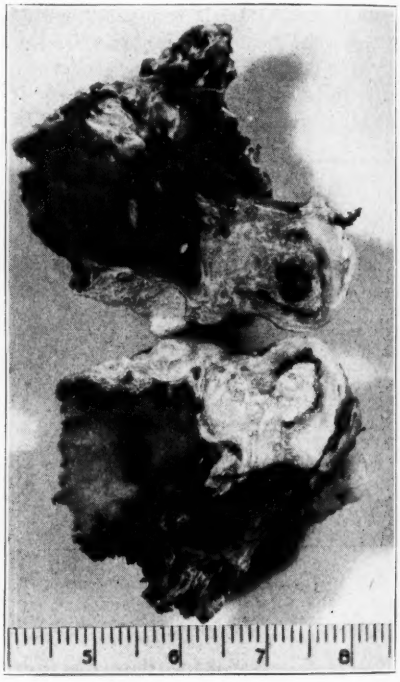

Fig. 7.—Inner or cut surfaces of the tumor.

tively large radiopaque body at the anteroinferior angle of the mass is plainly to be seen, and that the third molar is really a part of the mass is evident. The tumor is definitely confined in an unusually thick capsule. But more interesting still is its size. As you see, it extends from just behind the first molar down to practically the compact bone forming the lower border of the mandible and running along at that level back to the angle,

half way up the ramus coursing across the ramus just under the sigmoid notch to the anterior border. The upper surface presents anteriorly the third molar referred to above, and back of it the cavity and denuded part of the tumor as described. The lower first molar, which was slated for extraction, is, you will note, a perfectly normal tooth invested in normal bone and containing a normal pulp. Also, it is in normal occlusion with the related teeth of the upper jaw. Spontaneous fracture was very likely to occur, and I so informed the patient.

Operation.—A general anesthetic was out of the question, but with proper preparation at the hospital and conductive anesthesia, I removed the entire tumor mass, which was so firm in its bed that the erupted molar, which was part of it, broke off. I cleaned out the cavity, removing what fragments of capsule had not come with the tumor, and when I attempted to mold what was left of the lateral portion of the jaw, I found it so sclerosed from the previous treatment that I desisted rather than risk a fracture. Figure 2 shows the cavity in the mandible immediately after the removal of the growth. There is no fracture and the coronoid process still remains firmly attached. Figure 3 shows the deformity left after the operation. There is a great increase in width of the mandible.

Outcome.—The patient is making an uneventful recovery and the space is almost filled with new tissue. Packing was discontinued as soon as the exposed bone was covered with granulations. Even irrigation was dispensed with after the third week.

My hope is that, as maturation of the tissue takes place, the deformity will be correspondingly reduced. Barring accident, this jaw will eventually be stronger in what still is a very weak spot than in any other portion of the normal jaw. An examination of the tumor mass showed that it belonged to the composite variety of odontomas according to Bland-Sutton's or Perthes' classification and to the complex composite group which forms a subhead under composite odontomes as classified by the Committee of the British Dental Association. The dense structure (Fig. 4) occupied the antero inferior angle of the tumor *in situ* and proved to contain the crown of a molar tooth with an imperfectly formed occlusal surface. The buccal surface of the tumor is irregular and nodulated, rough, porous and deeply pitted, with enamel scattered promiscuously over it. Figure 5 shows the lingual surface of the tumor, which exhibits similar characteristics. Figure 6 shows the hole made in the previous operation. Figure 7 shows the two cut surfaces. There is an approach to the formation of a molar crown. The two lateral halves of the cavity are partly filled with granulation tissue and the hard cut surface is composed of the same structures described on the inner and outer surface of this tumor.

AMALGAM TECHNIC: DEPENDABLE AND DANGEROUS PRACTICES*

By N. O. TAYLOR†, Ph.D., Washington, D. C.

THE American Dental Association has maintained a research fellowship at the National Bureau of Standards since April, 1928. At that time, an extensive program of cooperative research on dental materials was inaugurated. The progress of this cooperative work will be reviewed here and particular mention be made of the work which has been done on amalgam alloys.

COOPERATIVE RESEARCH PROGRAM

It will not be possible, at this time, to give more than a brief outline of the items which make up the cooperative research program. A more complete outline will be found in the May, 1930, issue of THE JOURNAL. The following items include some of the major problems which have been considered and brief statements as to their present status.

The Inlay Casting Process.—The general problems involved in the production of a satisfactory cast inlay have occupied the major portion of the attention of the dental research group at the Bureau of Standards for the past year. The variables in the process have been carefully considered and a great deal of practical information has been given the dental profession in a report by R. L. Coleman.[1] No particular attention was given to the technics currently advocated until the summer of 1929. At that time, a survey of the current technics described in the dental journals was carried out. The properties of the investments used were determined, and the processes themselves were analyzed to determine their effectiveness for the purpose intended. An oral presentation of this material was made in October, 1929, but publication of the data obtained has been withheld pending the completion of some further work now in progress.

A group of about fifty inlay workers over the country have been studying the casting problems, and their preliminary report will be made at the coming American Dental Association meeting in Denver. They are primarily interested in making practical application of the laboratory data now available on dental materials and processes. While this cooperative work in the inlay process is progressing, the group at the Bureau of Standards is studying the materials necessary to the inlay process in the laboratory and expects to present, very soon, data on the properties of impression compounds, waxes and investments as well as suggested specifications for these ma-

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1. Bureau of Scientific Research, Paper 32.

terials. A stock of samples of inlay golds is being accumulated, and tests of these materials will be undertaken during the coming fall and winter.

In connection with the study of investments, it is of interest to note that workers at the Bureau (G. C. Paffenbarger, D.D.S., and Mr. W. T. Sweeney) have developed an entirely new type of casting investment, which has sufficient thermal expansion to compensate entirely for the casting shrinkage of gold. A similar investment was developed by workers outside the Bureau several months prior to the time this new investment was discovered by the Bureau group. The other workers produced it from a different material and by a different method. It is expected that this new type of investment will be on the market shortly.

Cast Partial Dentures.—A brief study was made of the cast partial denture process in 1929 and an oral presentation of the data obtained was made in October of that year. A cooperative group from the dental profession is now studying this field from the point of view of the practicing dentist and the reports will be combined for publication.

Dental Amalgam Alloys.—Early work on amalgam alloys at the Bureau of Standards: The first work on amalgam alloys at the Bureau of Standards was undertaken in 1919 to determine the quality of the materials on the market and to set standards for these materials for the use of the various Government purchasing agencies. The first report on the data obtained was published in 1920.[2] Tentative requirements for amalgam alloy were drafted and these were finally incorporated in Federal Specifications Board Specification 356 for Dental Amalgam Alloys, which was placed in use in 1926.

First American Dental Association work on amalgams: The first work undertaken under the cooperative research program in 1928 was a survey of the amalgams then on the market. This survey was intended as a means of selecting materials for other investigations, but as it was found that only six of twenty-six alloys tested would meet the Federal requirements, the results of the survey were given to the Scientific Foundation and Research Commission of the American Dental Association for their consideration. The Commission felt that the data should be published for the guidance of the dental profession.[3]

A considerable study of the effects of mechanical amalgamation on the properties of amalgam alloys was also carried out in 1928. The data secured indicated that mechanical amalgamation was definitely a dangerous practice in the light of the meager information supplied by the manufacturers of the equipment advocated for this purpose.

Recent work on amalgam alloys: The 1928 report on the properties of amalgam alloys was published with the names of the commercial products associated with the test results. This led to some very active protests on the part of alloy manufacturers who were making poor materials. Several of the group said that they would improve the quality of their products, as indeed they have. They have installed testing equipment and taken all the steps necessary to insure that their products shall be of uniformly good quality. Others made no effort to improve, but still insisted that it was their

2. Bureau of Standards Technologic Paper 157.

3. Taylor, N. O.: Mechanical Amalgamation, J. A. D. A., 16:583 (April) 1929; Survey of Amalgam Alloys, ibid, 16:590 (April) 1929.

right and privilege to sell poor materials as long as any dentist would purchase them. Two firms withdrew from the amalgam field. Others continued to make poor products with the evident intention of producing low-grade alloys until the profession refused to buy them.

In 1929, a second survey of amalgam[4] alloys was carried out. Forty-four alloys were tested, and again the majority of the materials tested were found to be of poor quality. The Federal specification and the data secured in the 1928 and 1929 surveys were used as a basis for the American Dental Association Tentative Specification for Dental Amalagam Alloys. The essential requirements of the two specifications are given in Table I.

TABLE 1.—Essentials of Federal and A. D. A. Amalgam Specifications.

I. General requirements
- A. Thorough, smooth amalgamation in three minutes
- B. Susceptibility to carving for fifteen minutes
- C. Ability to take and retain a polish after 24 hours

II. Chemical composition
- A. Silver, 65 to 70 per cent
- B. Tin, 26 to 29 per cent
- C. Copper, 3 to 6 per cent
- D. Zinc, 0 to 2 per cent

III. Dimensional changes
- A. Not over 0.04 per cent shortening during twenty-four hours
- B. At end of 24 hours, lengthening 0.01 to 0.1 per cent

IV. Ultimate crushing strength
- A. Minimum 35,500 pounds per square inch after five days

V. Flow
- A. Must not flow over 5 per cent in twenty-four hours under 3,550 pounds per square inch, starting 3 hours after packing

VI. Directions
- A. Packages must contain adequate and accurate instructions
- B. Packages carry serial number or date of manufacture (A. D. A. only)

4. Taylor, N. O.: Specification for Dental Amalgam Alloys, J. A. D. A., 17:112 (Jan.) 1930.

Other Fields.—In addition to the previous items, vulcanite, vulcanite substitutes, porcelain, synthetic porcelain and cements have been listed for consideration, but lack of funds has made it impossible to take up any problems in these fields. The program also has other items which include:

1. The drafting of specifications for dental materials of all types.

2. The compilation of a list of laboratories which are equipped to test dental materials. At present, we are interested in those laboratories which can make satisfactory tests of amalgam alloys. A considerable number of schools and laboratories have been supplied with standard samples for tests so that comparisons of their work can be made. To date, the Bureau of Standards has been advised that three laboratories (by K. W. Ray, Chemistry Dept., State University of Iowa, Iowa City, Iowa; R. M. McCormick, Stratford Cookson Co., 4058 Haverford Ave., Philadelphia, Pa. and Dean M. L. Ward, University of Michigan, Ann Arbor, Mich.), that three laboratories are prepared and willing to do amalgam testing.

3. All assistance possible to dental educational projects and every effort to assist schools or other institutions who are interested in the installation of testing equipment.

AMALGAM TECHNIC

The primary topic for discussion at this time is amalgam technic. Amalgam, for years the most largely used of all filling materials, has been the means of saving or prolonging the usefulness of a vast number of teeth. It is unfortunate that

the materials used have not always been of good quality and that the technic employed has not been the best, and as a result the number of teeth saved has not been so large as it might have been. Amalgam has been unjustly condemned in many cases on the basis of the use of faulty materials and faulty technic, and the dental profession has been advised to turn to other filling materials, which, in many cases, may be properly subjected to as great if not greater criticism than may the amalgam.

There are many indications that an amalgam alloy of good quality, properly manipulated and inserted in a cavity, should give as good service as the best gold inlay and much better service than the average inlay. The present problem is to consider the factors which enter into the production of a good amalgam and to distinguish between dependable and dangerous practices in the manipulation of this type of material.

Selection of Alloys for Use.—The first step in the production of a high-grade amalgam filling is the selection of an alloy of good quality. The dental profession has been forced to rely on the manufacturers of alloys for any information as to quality of materials for many years. The information given was largely sales propaganda, and in the light of our present knowledge, we know that both the information given and the materials sold were of very poor quality in most cases. There were marketed many materials of properties entirely unknown to the manufacturer, who neither knew nor cared to know more about his product than the profit which it brought him.

The institution of the Federal Specification for Dental Amalgam Alloys gave the first real standard for this type of materials. The American Dental Association reports bearing the names as well as the properties of the alloys on the market gave the profession its first opportunity to compare the quality of the current alloys. The American Dental Association Specification was based upon the Federal Specification and the surveys of alloys conducted in 1928 and 1929.

Proper use of specifications: The specifications for amalgam alloys provide a means of separating the better materials in the field from those of definitely poor quality. They are not intended to provide a rating system, to compare one satisfactory alloy with another, nor should they be so used.

It has been unfortunate that the manufacturers of dental amalgam alloys have been forcing the rating idea on the dental profession through their advertising. They have been interested only in making use of the published reports to further their own ends. Several examples of such activities will illustrate this point.

The reports on amalgam alloys gave the data on expansion and contraction to the nearest half micron and consequently slight shrinkages of 0.2 microns per cubic millimeter are reported as zero. The manufacturer of one alloy advertised extensively that his was the only alloy having no contraction. This was of course untrue, since his alloy did have a very slight initial contraction; but he stressed this as the outstanding property of his alloy, when, as a matter of fact, he had no means in his plant at that time to determine whether or not his material had any setting contraction or expansion.

The specifications require that amalgams show a crushing strength of 35,500 pounds per square inch when tested between 20 and 25 C. The better grades of alloys show from about 46,000 pounds to 48,000 pounds crushing strength when tested at 25 C. If the tests are conducted at 20, the temperature may increase the

strength approximately 10 per cent. If the room temperature variations are considered, it can be normally expected that alloys tested during the cooler portions of the year may show higher strengths than those tested during the summer months.

In 1928, the first alloys were tested early in April, and one of these showed high crushing strength. The manufacturer of this particular alloy accordingly claimed that his product surpassed all others in crushing strength. This year, the same alloy was tested in the middle of the summer and was not at the top of the list. The quality of the alloy was possibly not changed to any considerable extent, but the manufacturer's competitors became enthusiastic in pointing out the apparent change. The manufacturer also entered the field with some exaggerated claims as to the strength of his product, claiming very high crushing strengths when it was tested by what he chooses to call "standard" methods. It is interesting in this connection that he considers mechanical packing at pressures far above those which can be used in practice a fair standard and that he uses a sample whose diameter is approximately equal to its own length, which is contrary to all standard testing practice. Both of these factors tend to give values higher than could be obtained by hand packing and by testing samples whose lengths are twice their diameters.

The specifications require that alloys be uniform and free from foreign materials. The presence of nonmetallic impurities in the alloy is evidenced by blackening of the hand in trituration, and while there is no set standard, observations are made, as alloys are tested, as to their tendency to blacken the hand. There are at least two factors in this blackening: (1) the presence of foreign materials, such as metallic oxids or sulphids; and (2) the presence of extremely finely divided material. The first may be corrected by the use of great care in preventing oxidation or contamination in melting and cutting the alloy. A small amount of oxidation occurs in practically every case. Some manufacturers claim to remove the impurities by washing the oxids off the surfaces of the alloy particles with acid washes, but this could not remove any impurities inside the particle, and these may appear as the mercury dissolves the surface layers during amalgamation. Others use zinc to obliterate the blackening effect, since the zinc compounds are white and comparatively invisible during the trituration process. Finely divided material may be removed by screening.

The proper use of the specification is as a basis for the determination of a group of good materials. The selection of a particular alloy for use by the individual dentist should be made from this group, the alloy being selected which seems, by virtue of its working properties, to be best suited to his needs.

Factors Under the Control of the Manufacturer.—The ability of an amalgam alloy to meet the requirements of specifications is under the control of the manufacturer.

Composition: The chemical composition of an alloy affects its final properties, but alloys of identical chemical composition may not have the same properties, owing to the influence of other factors. Silver tends to increase the setting expansion, while tin causes shrinkage. Copper serves to increase strength and zinc has a very pronounced effect on flow and may also influence other properties, as previously mentioned. The composition of the alloy must be determined too, so that the final product will have accept-

able properties after subjection to the manufacturer's standard manufacturing process.

Cutting and annealing: The cutting of the alloy into chips or shavings determines its final characteristics to a marked extent. The cutting process sets up stresses in the metal particles which, if not removed by an annealing process, may be slowly removed over long periods of time by recrystallization at room temperatures.[5] Freshly cut alloys, unannealed and consequently in a state of stress, tend to expand greatly on amalgamating. The presence of coarse particles also tends toward expansion. The annealing of the cut alloy changes its characteristics by making it softer working and also slower setting, and lowers the expansion, or may even cause contraction on setting. An ideal annealing process would be one which caused the complete removal of stress and left the alloy free from any further tendency to change. Such a process, coupled with proper particle size and chemical composition, would give a material whose properties would remain constant over long periods of time. It is unfortunate that, at present, many alloys are only superficially annealed and, after standing for some time, may show contraction on setting, where they previously showed expansion.

Particle size may be a cause of blackening, and very finely cut alloys as a rule show contraction on setting. Screening to control uniformity of particle size aids in obtaining uniform properties in an alloy.

Directions for use: An alloy as it comes from the manufacturer's hands should be stable and should meet the requirements of the specifications. There is a requirement that adequate instructions for the use of the alloy must accompany each package. This appears to have been completely overlooked, and there is now no alloy on the market which carries adequate or accurate directions for its use. In most cases, the manufacturers have so little information that they could not give suitable instructions. In a few cases, the manufacturers have the necessary information but hesitate to give it since, in many instances, as we shall see later, the directions would be contrary to the usual practices of the profession and directly opposed to the teaching of dental colleges and amalgam clinicians as to the proper methods of manipulating amalgam.

Conditions Under the Control of the Dentist.—The final properties of any filling are determined by the dentist who inserts it in the cavity. There are several steps in the ordinary amalgam technic which may have a direct bearing on the properties of the resulting filling. These steps will be considered in the order in which they are encountered in practical use. Most of the discussion will be based upon the effects of the various factors on the setting changes of the alloys, although mention will be made of other effects when they are important. The discussion will further be confined to effects observed in testing high-grade materials.

No attempt will be made to discuss such phases of amalgam technic as are included in the various stages of cavity preparation and of the various methods of instrumentation.

Alloy-mercury ratio: The proportions of alloy to mercury used in making a mix are commonly expressed in what is known as the alloy-mercury ratio, in which the ratio of the weight of alloy used to that of the mercury is given as 5:7, 5:8, 7:9, 9:11, etc. Sufficient mercury should be used to make a plastic mix at the end of

5. Black, G. V.: Operative Dentistry.

a three-minute trituration. The proportions of alloy to mercury can be varied over fairly wide limits without causing appreciable effects in the setting characteristics of the alloys. The setting time can be prolonged by the use of larger portions of mercury and this is often of advantage in inserting a large filling. If the alloy is allowed to stand too long before use, the initial set may take place and render it unfit for use.

Mixing time: The mixing time should not be less than two and a half minutes since experience has demonstrated that at least that amount of time is required to produce a plastic mix by ordinary trituration. Three minutes is perhaps the general average time used in triturating amalgams. In the absence of specific directions to the contrary, laboratory test samples are mixed one minute in the mortar to incorporate the mercury in the alloy and then mulled in the hand for two minutes. The hand is more effective than the mortar in producing a plastic mass in the same length of time unless excessive pressures are employed in grinding. A slightly larger proportion of mercury is necessary if all the mixing is to be carried on in the mortar.

Undue prolongation of the mixing time tends toward shrinkage during the setting period. This fact has been known and recorded in the dental literature for at least ten years,[6] and yet clinicians are still advocating that amalgam be continually agitated until it is inserted in the cavity. Such undue working causes shrinkage and low crushing strength.

Mixing or grinding pressure: One of the outstanding points of divergence between laboratory findings and the commonly used amalgam technics is the mixing or grinding pressure indicated. Instructions are frequently given to grind the alloy with the mercury in making the mix for periods of from three to five minutes, and the term "grind" is taken to mean just what the term implies, namely, breaking up the alloy under heavy pressures. The operator is told to use heavy wrist pressure. These heavy pressures break up the alloy particles, and some of the energy is converted into heat, the combined effect being to produce a shrinking amalgam. The following case may be considered as an illustration of this point: A number of mixes were made of an alloy under carefully controlled conditions. The grinding pressure alone was varied. Several samples were mixed, not ground, in the mortar, the pestle being held loosely in the hand and no pressure applied other than the weight of the pestle. Samples of another group were ground, with heavy hand pressure on the pestle. The group mixed under light pressure showed an average expansion of 4.5 microns per centimeter in twenty-four hours. The group mixed under heavy pressure showed a contraction of 2.0 microns per centimeter in twenty-four hours. Heavy pressure in grinding should be avoided as it has much the same deleterious effect as mechanical amalgamation.

Addition of mercury: It is often said that if mixed amalgam has started to set, it will do it no harm to add more mercury to soften it, and then proceed with its use. This is a practice which is definitely unsafe. The addition of small proportions of mercury will have little effect on the setting characteristics of an alloy, but it does affect the crushing strength to a marked extent. The first drop of mercury added to soften an average sized mix of alloy gives a product whose strength shows a decrease to 80 or 90 per cent of the normal value. If the material is

6. Bureau of Standards Technologic Paper 157.

softened a second time, the crushing strength may be as low as 5 per cent of the normal value.

Packing pressure: So far, only those variables have been considered which enter into amalgam technic prior to the insertion of the filling in the cavity. In considering the condensation of amalgam in the cavity, it is convenient to separate one item from the general consideration of packing methods and to review the effects of variation in the packing pressures employed. The general tendency has been to advocate extremely high pressures in packing. Clinicians have recommended that pressures as high as 12 pounds be exerted on a small plugger, and have often demonstrated their ability to obtain such pressures with various mechanical devices. These devices have often indicated the high pressures, but, on investigation, some of the instruments have been found to show as high as a 50 per cent error between the indicated and the actual pressures. Such high pressures can seldom be obtained in practice.

The workers in the field who have actually tried to determine the pressures which can be used in practice report that from 3 to 4 pounds represents the average obtainable on small pluggers, while others believe that 2½ pounds would be a better average. If extracted fillings are examined, one is inclined to favor the latter figure, as many fillings are found which seem to have been forced into place with the operator's finger or thumb.

The advocating of heavy packing pressures has been based upon the assumption that such pressures would produce stronger fillings. Such is actually the case, but it is also true that increasing the packing pressure does not give proportional increases in crushing strength. On the other hand, comparatively low pressures will, if proper methods are employed, give fillings with ample strength (from 37,000 to 38,000 pounds per square inch).

In considering the effect of packing pressure on the setting characteristics of alloys, it is found that the better alloys will show marked expansion if light packing pressures are employed. As the packing pressure is increased, the tendency toward expansion decreases, rapidly at first, then more slowly, until, as high pressure ranges are reached, the setting changes in the resulting amalgams are more or less constant. The data presented in Table 2 illustrate this point and represent averages of tests when all factors other than packing pressure were held constant.

TABLE 2.—EFFECT OF PACKING PRESSURES ON SHRINKAGE AND EXPANSION

How Packed	Change in 24 hours (Microns centimeter)
Vibrated; no instrument used	+18.0
Vibrated; instrument used to condense slightly	+13.0
Pressure on plugger, 1.5 mm. in diameter—	
2 pounds	+ 5.5
4 pounds	+ 2.0
6 pounds	+ 0.5
8 pounds	+ 0.0
Malleted to place	— 1.0

In the few cases in which the manufacturers of amalgam are cognizant of this effect, their products have been so balanced and annealed as to show expansion under the pressures commonly obtained in the mouth.

These data are not to be construed as meaning that thorough condensation of amalgam is not the best practice. If the operator, in his practice, uses small pluggers and succeeds in maintaining 3 or 4 pounds as an average packing pressure,

he will find that satisfactory fillings will result.

Packing methods: There are several items which may be mentioned as making up packing methods aside from packing pressure.

The first portions of alloy placed in a cavity should be soft and plastic. Condensation should take place first at the edges, followed by wedging pressure, exerted in the central portions of the cavity. Alloy should be added in small pieces, with some of the mercury expressed, but care should be taken to have the surface of the filling wet with mercury at all times during the packing operation.

Many dentists have a tendency to pack the alloy very dry and to burnish one piece after another into the cavity. This produces alternate wet and dry layers, and when the material sets, the layers do not adhere and so may cause the filling to be brittle or, to use a common term, lack edge strength.

The last layers placed in a cavity may be used very dry in order to absorb any mercury which has been gradually rising to the surface.

Instruments: Frequently, questions arise concerning the relative merits of smooth and serrated instruments. The use of varying shapes and surfaces on instrument faces seems to affect the physical properties of the resulting alloys little if any. The faces of serrated pluggers become coated with amalgam, and, unless the faces are cleaned at frequent intervals, the pluggers act exactly as smooth surfaced instruments. Serrated instruments may, at times, be more convenient for use in conveying small portions of alloy to the cavity.

Wet or dry cavities: The cooperating amalgam committee has carried on some experiments on the effects of the saliva's coming in contact with the alloy during the packing process. It was found that the saliva had little or no effect on the setting changes, but that the crushing strength of the amalgams decreased about 20 per cent. The lowered crushing strength was associated with a laminated condition and with considerable brittleness.

Finishing: It has been observed that amalgam alloys, after insertion and contouring, gradually develop a peculiar surface condition. The surfaces, which were bright after carving and burnishing, lose their glossy appearance, and what might be called a bloom develops as a result of the crystallization of the alloy.

The initial set of the better alloys is rapid, but the final set may extend over long periods. If the final polishing of a filling is attempted just after insertion, the surface brightness will disappear before the next day. The resulting surface feels like smooth satin, but unless the surface is repolished, the alloy will not exhibit its highest resistance to corrosion or discoloration.

Every amalgam should be polished to give the best possible service. This polishing requires that the patient return for a second sitting. Many practitioners say that they cannot afford to do this final polishing for the price paid for the amalgam filling, but they should remember that their product will be of lower quality if they neglect this step.

It is a common occurrence, in finishing amalgams, to fail to remove overhanging gingival margins. This may lead to serious future complications through tissue irritation.

SUMMARY AND CONCLUSION

To summarize: It is unsafe practice to (*a*) select and use low-grade alloys; (*b*) overtriturate; (*c*) use heavy grinding pressures; (*d*) work the alloy after

the initial trituration; (*e*) add mercury after the mix is made; (*f*) use excessive packing pressures; (*g*) permit saliva to come in contact with the alloy while packing; (*h*) condense insufficiently and without attention to uniformity; (*i*) fail to finish the surface margins of fillings properly. It is safe practice, or an acceptable amalgam technic in the light of present knowledge of amalgam alloys, to (*a*) select a high-grade alloy: (*b*) use ample alloy to mercury to assure a plastic mass in three minutes; (*c*) incorporate the mercury in the alloy under light pressure; (*d*) avoid working the alloy after the initial trituration; (*e*) add no mercury after the mix is made; (*f*) condense carefully and thoroughly, keeping the surface of the filling wet with mercury until the final portion is added; (*g*) polish the surfaces and margins of the filling at least twenty-four hours after insertion.

Amalgam has in the past been unjustly condemned because of the poor quality of the average material in the market. An amalgam alloy of good quality, properly made, correctly manipulated, uniformly condensed and carefully finished will produce satisfactory and serviceable fillings.

THE EPITHELIAL ATTACHMENT AND SO-CALLED NASMYTH'S MEMBRANE*

By RUDOLF KRONFELD, M.D., Chicago, Ill.

A DEFINITION OF THE EPITHELIAL ATTACHMENT

As Gottlieb's finding concerning the true relationship between the epithelium and tooth surface[1] is not yet satisfactorily understood, I wish to discuss further a few of the more important phases of this problem. The last papers dealing with this subject to appear in this country were those by Orban and Mueller,[2] Becks[3] and Skillen.[4] The paper of Orban and Mueller offers a complete outline of the problem, with an extensive bibliography. Becks makes a contribution to the process of detachment of the epithelium from the tooth surface and to the relationship between mouth epithelium and the epithelial attachment. Criticisms which will arise from his statements regarding the conditions found when the bottom of the crevice reaches

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*Read before the Chicago Branch of the International Association for Dental Research, May 5, 1930.

1. Gottlieb, Bernhard: Tissue Changes in Pyorrhea, J.A.D.A., 14:2178 (Dec.) 1927; Formation of the Pocket; Diffuse Atrophy of Bone, ibid., 15:462 (March) 1928.

2. Orban, Balint, and Mueller, Emil: The Gingival Crevice, J.A.D.A., 16:1206 (July) 1929.

3. Becks, Hermann: Normal and Pathologic Pocket Formation, J.A.D.A., 16:2167 (Dec.) 1929.

4. Skillen, William: Morphology of the Gingivae of the Rat Molar, J.A.D.A., 17: (April) 1930.

the cemento-enamel junction are discussed in the latter part of this paper. Skillen's paper deals with the epithelial attachment on the molars of rats and shows generally about the same changes as those described by Orban and Mueller and Becks.

There is a basic difference between the old and the new conception of the conditions found around the tooth, and it is this difference that I wish to emphasize.

Old Conception.—The epithelium is attached to the tooth in a line around the cemento-enamel junction. (Fig. 1, left side, at *c.*)

New Conception.—The epithelium is not attached in a line but in a band. This

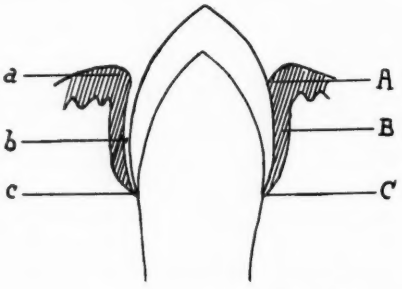

Fig. 1.—Diagram illustrating the difference between the old and new conceptions of the attachment of the gum to the tooth. The small letters are used to illustrate the old conception; the capitals, the new conception. *a*, free gingiva. *b*, subgingival space. *c*, gingival line. *A*, bottom of the gingival crevice. *B*, epithelial attachment. *C*, cemento-enamel junction (deepest point of the epithelial attachment). (From Orban and Mueller: "The Gingival Crevice.")

band (Fig. 1, right side, *A-C*) surrounding the tooth has an organic connection with the tooth surface: band and tooth surface are grown together. This condition is found in man and in all mammals and many other animals.

Gottlieb,[5] who for the first time recognized and described this condition, called that part of the epithelium which is united with the tooth surface *Epithelansatz*, which has been translated as "epithelial attachment." I feel it necessary to mention the fact that the term "epithelial attachment" was coined not more than nine years ago in order to denominate a thing formerly unknown and therefore without a name. I mention this because I know that there has been some

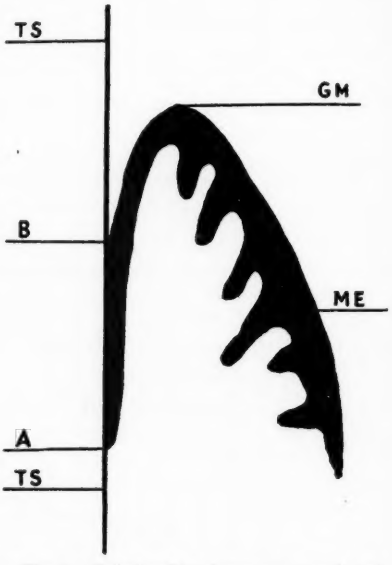

Fig. 2.—Relationship between mouth epithelium and tooth surface. *TS*, tooth surface; *ME*, mouth epithelium; *GM*, gingival margin; *B*, bottom of the gingival crevice; *A*, deepest point of the epithelial attachment; *GM-B*, depth of the gingival crevice; *B-A*, length of the epithelial attachment (width of the epithelial band that is united with the tooth surface).

disagreement as to whether or not the

5. Gottlieb, Bernhard: Der Epithelansatz am Zahn, Dtsch. Monatschr. f. Zahnheilk.; 1921, No. 5.

term "epithelial attachment" is absolutely correct from the linguistic standpoint. It has so often been explained that there should be no more disagreement over its use in dental terminology.

The epithelial attachment is the band of epithelium which has united with, or is in organic connection with, the tooth surface. The presence of this epithelial attachment will be evident to anyone who studies well-preserved and well-prepared jaw material from man and animals. There are great differences as far as the location of the epithelial attachment on the tooth surface is concerned. We will see that the relationship of the epithelial band to the enamel and cementum of the tooth varies greatly in different types of teeth, in different individuals and at different ages. The width of the epithelial attachment can also vary; but it should be stated again that wherever a tooth rises through the mouth epithelium, the epithelium is united with it in the form of a band.

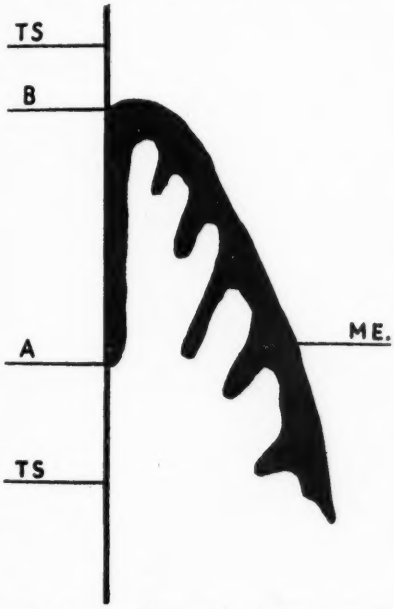

Fig. 3.—Drawing showing Figure 2 modified according to the conditions found when no gingival crevice is present. In this case, the points *GM* and *B* coincide. (Compare with the photomicrograph in Figure 4.) *TS*, tooth surface; *ME*, mouth epithelium; *B*, point of junction of the mouth epithelium with the tooth surface, corresponding to *B* in Figure 2; *A*, deepest point of the epithelial attachment; *B-A*, length of the epithelial attachment.

Another question that might arise is: Why has this condition not been found and described before, since so many people are working in the field of dental histology? I shall try to answer this question. One of the chief reasons that, for a long time, the investigators in this field overlooked in their specimens the attachment of the epithelium to the enamel seems to be that they did not completely understand the changes brought about by the loss of the enamel after decalcification. They might even have seen cuticle detached at the bottom of the crevice from the epithelial attachment, but they failed to draw any conclusion from this finding, as they were convinced that the crevice must end at the cemento-enamel junction. Another reason for the misunderstanding of the problem was the lack of a proper histologic technic. Anyone who has worked with frozen or paraffin sections of teeth together with the surrounding structures knows how easy it is to produce distortions and artificial tears. In specimens so prepared, almost invariably we find the epithelial attachment torn away from the tooth surface and attached only at one point, a condition which is never found in life and which is caused by an artefact. (Compare Figures 22, *C*, and 23, *C*, in Orban and Mueller.[2] These photomicrographs show plainly how to

recognize tears made in the preparation of slides.)

Another reason for the misconception concerning the epithelial attachment is the fact that histologists persist in drawing conclusions concerning normal histology upon the basis of a few specimens. It is difficult to find a normal epithelial attachment in sections showing extensive inflammation and destruction of the lining epithelium. A very good picture of this type of condition has been reproduced by Orban and Mueller in their Figure 12.[1] From a specimen like this in which many artificial tears are combined with severe inflammation and infiltration, a proper conception of the epithelium attachment can never be

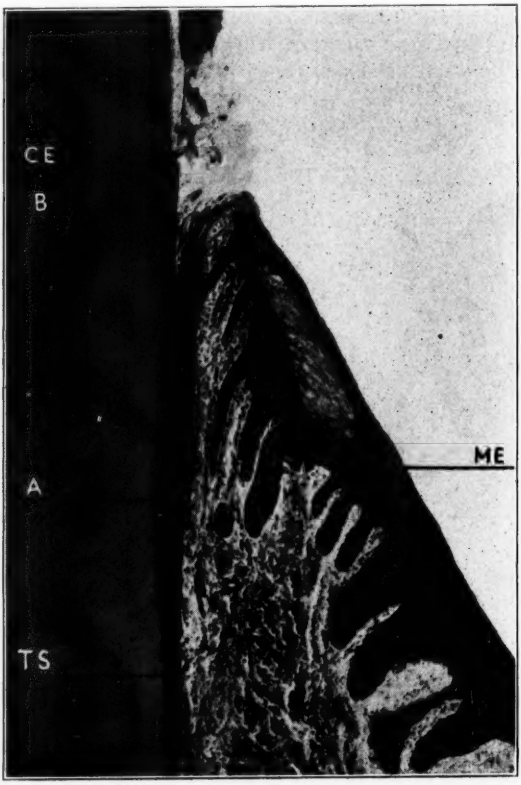

Fig. 4.—Epithelial attachment on a human upper molar. (Compare this photomicrograph with the drawing Figure 3.) *TS*, tooth surface (cementum); *CE*, cemento-enamel junction; *ME*, mouth epithelium; *B*, point of junction of the mouth epithelium with the tooth surface; *A*, deepest point of the epithelial attachment; *B-A*, length of the epithelial attachment. There is no gingival crevice present as the gingival margin coincides with the upper edge of the epithelial attachment at *B*. (×55.)

formed. Only serial sections of well-fixed normal jaw material, which have been sectioned after being imbedded in a fairly resistant material (celloidin), to afford sufficient support and to prevent tears of the tender structures, can serve as a proper basis for histologic study.

RELATIONSHIP BETWEEN EPITHELIAL ATTACHMENT AND GINGIVAL CREVICE

Before entering into the main part of this paper, I wish to repeat again a few things concerning the terminology and the relationship between the epithelial attachment and the gingival crevice.

In this drawing, *TS* indicates the tooth surface; *ME*, the mouth epithelium covering the outer side of the alveolar process, and *GM*, the gingival margin. From *GM* to *B*, the epithelium lines the gingival crevice. The bottom of the gingival crevice is found at *B*. The distance from *B* to *GM*, therefore, constitutes the depth of the gingival crevice. The epithelial attachment extends from *B* to *A*, with *A* as the deepest point of the epithelial attachment. From this drawing, it can be seen that the epithelial attachment forms a so-called band the width of which is equal to the distance *A-B*.

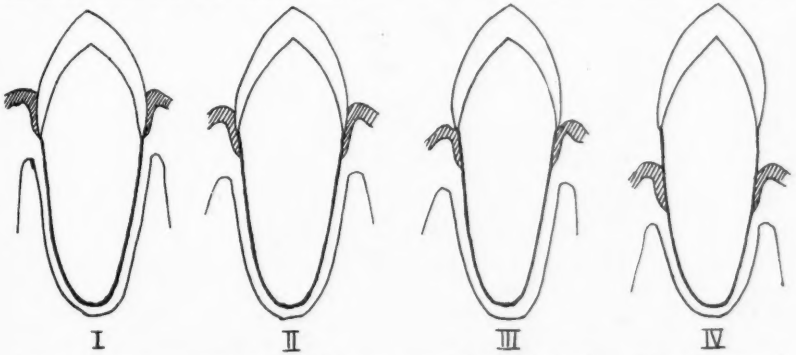

Fig. 5.—Diagram illustrating four different stages of the relationship existing between the tooth and the surrounding tissues, especially the epithelial attachment. *I*, bottom of the crevice on the enamel, deepest point of the epithelial attachment at the cemento-enamel junction. *II*, bottom of the crevice still on the enamel, but the deepest point of the attachment is already on the cementum. *III*, bottom of the crevice just at the cemento-enamel junction; the epithelial attachment on the cementum. *IV*, bottom of the crevice on the cementum, the deepest point of the epithelial attachment shifted further apically. (From Orban and Mueller, "The Gingival Crevice.")

Figure 2 illustrates the normal relationship between the epithelium and the tooth surface. I have purposely made no distinction as to the distribution of tissues on the tooth surface (enamel or cementum), since this drawing covers all possibilities and all ages in man and animals.

This band surrounds the tooth, the upper margin of it coinciding with the bottom of the gingival crevice. It has been frequently shown that the depth of the gingival crevice varies greatly in different cases. Sometimes, the pocket has no depth at all. In such cases, the drawing has to be modified in order to correspond to the modified condition. (Fig. 3.) The

gingival margin coincides with the bottom of the crevice; but the epithelial attachment is not altered by this fact. This condition, i. e., a gingival crevice without depth or almost without depth, has often been found in specimens taken from healthy animals of all ages. It has also been found in man, though not frequently. The reason that very shallow pockets are not more often found in human jaw material is easily explained by the fact that our material is without exception taken from the poorest class of people who, as a rule, died after a long illness in a charitable hospital. As little or no hygienic care was exercised in these cases, inflamed gingivae and deeper gingival crevices are quite regularly found.

Fig. 6.—Interdental space between a central and a lateral incisor (lower). *a*, calculus. *b*, gum tissue. The space between *a* and *b* is due to shrinkage. *c*, enamel. *d*, bottom of the crevice. *e*, cemento-enamel junction. *f*, deepest point of the epithelial attachment. *g*, epithelial attachment. *h*, dentin. *i*, cementum. (From Orban and Mueller, "The Gingival Crevice.")

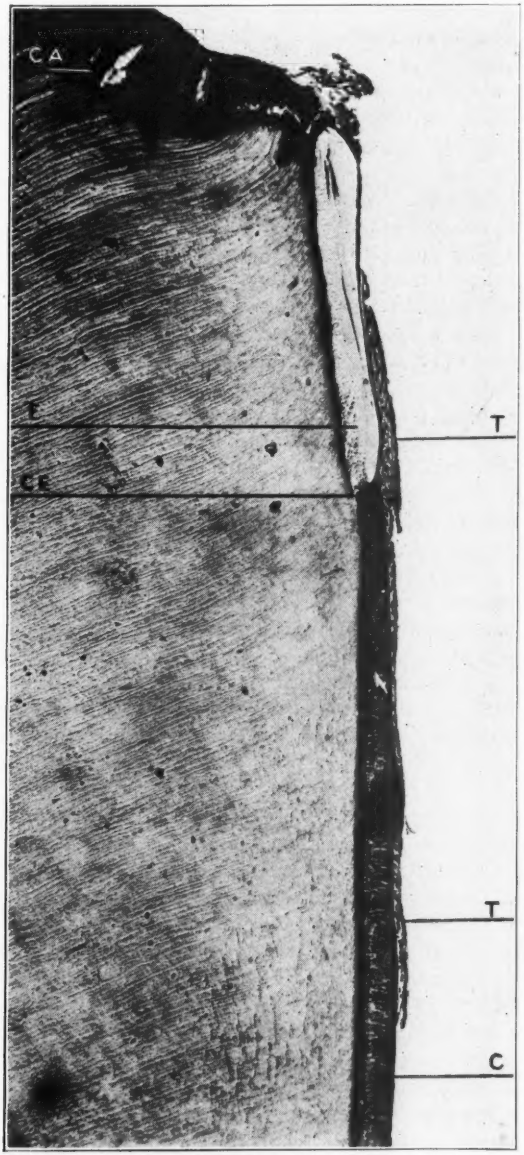

Fig. 7.—Cemento-enamel junction of a human lower bicuspid. The tooth was extracted, decalcifed and imbedded in celloidin. *C*, cementum; *CE*, cemento-enamel junction; *E*, enamel rests; *CA*, caries; *T*, soft tissue in connection with the enamel, *E*, and with the cementum, *C*. (×85.)

I cannot explain this fact better from the clinical standpoint than by quoting Orban and Mueller.[2] "We seldom see a mouth in ideal hygienic condition, but when we do, we very often find shallow crevices. The better the mouth hygiene, the better the condition of the gingival crevice, and the shallower the crevice." Therefore, we can conclude as to the relationship between the gingival crevice and the epithelial attachment that: 1. The epithelial attachment (Figs. 2 and 3, *A-B*) varies in length, but it is never negative, that is, the points *A* and *B* will never coincide. 2. The gingival crevice (Fig. 2, *GM-B*) varies between great depth and no depth at all. In the latter case, the points *GM* and *B* coincide. (Fig. 3.)

Therefore, in studying normal material, we will always find an epithelial attachment but not necessarily a gingival crevice. Figure 4 illustrates the latter condition; i. e., absence of gingival crevice. The photomicrograph is taken from the lingual root of an upper first molar of a boy, aged 19, who showed a fairly good hygienic oral condition. The entire epithelial attachment lies on the root surface, the "bottom of the crevice" is a short distance below the cemento-enamel junction, *CE*. The length of the epithelial attachment (*B-A*) in this section is 0.8 mm. At the point of detachment of the epithelial attachment from the tooth surface (*B*), we see a few desquamated epithelial cells, such as are usually found on the surface of the epithelium; but there is no evidence of a crevice If we measured the distance from the highest point of the epithelium to the bottom of the crevice, we would get a distance of less than half the thickness of the epithelium, that is, less than 0.1 mm. A case such as this can practically be considered as presenting no gingival crevice.

LOCATION OF THE EPITHELIAL ATTACHMENT ON THE TOOTH SURFACE

Up to this point, I have made no distinction between the different kinds of hard tissue that form the tooth surface. I merely used the term "tooth surface," and wished thereby to imply that *these* conditions as regards the epithelial attachment are generally found in all teeth of man or animal. As I am now going to deal more specifically with the relationship of the epithelial attachment to the different parts of the tooth, I shall have to discuss a new factor, the migratory character of the epithelial attachment. This was observed by Gottlieb as a result of studies on human and animal material. In his studies, he was able to show that the epithelial attachment has no constant location on the tooth surface throughout life. Its deepest point (*A*, Figs. 2-4) is continuously shifting apically; whereas, at the highest point (*B* in Figs. 2-4), the epithelial attachment is gradually detaching itself from the tooth surface. The rate of these two processes (downward growth and detachment) can show great variation. The process may occur so slowly that clinical observation even over a period of years may not disclose any change. In animals, on the contrary, the process occurs much faster and more regularly in that type of teeth which are continuously growing (for example, the incisors of rats). To get the true conception of the migratory character of the epithelial attachment, it is necessary to study many specimens of all ages of the same species. The sequence must be obtained by joining all these single histologic pictures showing the different positions, and by using these to construct a mental moving picture of the process.

We know that different types of teeth are to be found among the mammals.

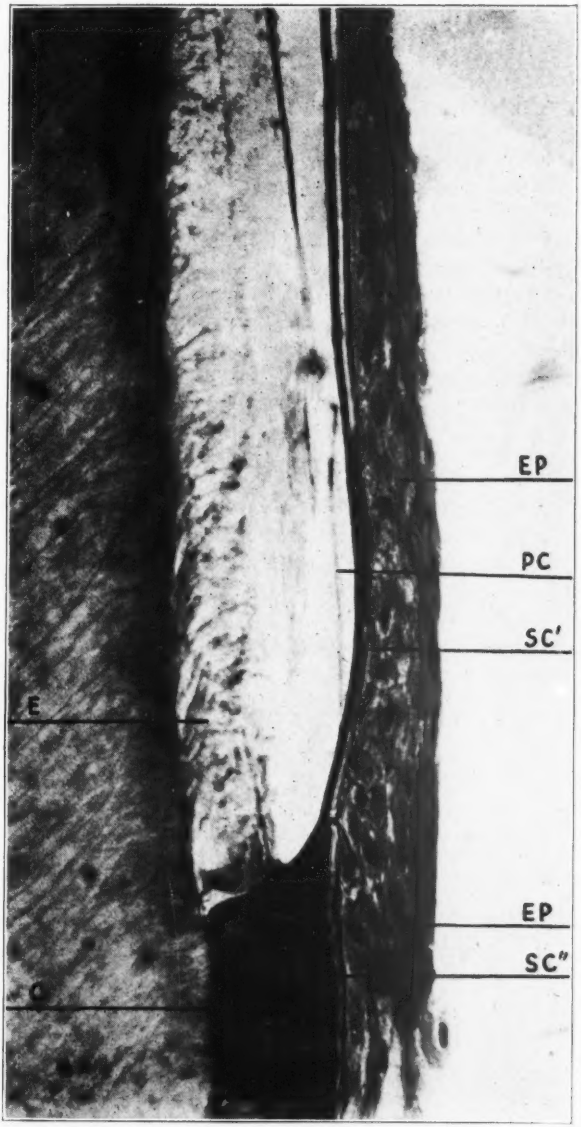

Fig. 8.—Higher magnification of Figure 7. *E*, enamel rests left after decalcification; *C*, cementum; *SC'*, hornified secondary cuticle on the enamel; *SC"*, hornified secondary cuticle on the cementum; *PC*, primary cuticle; *Ep*, stratified squamous epithelium of the epithelial attachment. This epithelium was torn off from the mouth epithelium and from the retro-epithelial connective tissue by the extraction of the tooth and remained attached to the tooth surface. (×550.)

Therefore, in discussing the relationship between the epithelial attachment and the tooth surface, it is necessary to describe these main types and to discuss each separately. The three main types of teeth found among mammals are: (1) man, (2) rodents and (3) herbivora.

1. *Man.*—The tooth consists of a crown, covered with enamel, and of a root, covered with cementum. The cemento-enamel junction forms a circular line around the tooth. These teeth have a constant apical foramen when the growth of the root is completed. Representatives are man, monkey, all carnivora, insectivora, some rodents (molars) (rat, mouse) and a few smaller groups of animals.

In this type of teeth, the epithelial attachment in youth is found on the crown surface only. Figure 5, *I,* shows the epithelium in organic connection with the enamel. The bottom of the crevice is located on the enamel and the deepest point of the epithelial attachment lies at the cemento-enamel junction. As the individual becomes older, the detachment of the epithelium from the enamel continues and the epithelial attachment becomes narrower. Before the bottom of the crevice reaches the cemento-enamel junction, the deepest point of the epithelial attachment passes the cemento-enamel junction and thus is found partially on the enamel and partially on the cementum. (Fig. 5, *II.*) Later on, as the process of detachment reaches the cemento-enamel junction, the bottom of the gingival crevice is found at the cemento-enamel junction; also while the deepest point of the epithelial attachment is well down on the root surface. (Fig. 5, *III.*) Finally, the bottom of the crevice passes the cemento-enamel junction and is found on the cementum. The entire epithelial attachment thus lies on the cementum. (Fig. 5, *IV;* Fig. 4.) It has been frequently mentioned; and should be repeated again here, that the rate of detachment and downward growth of the epithelial attachment is never uniform around the whole circumference of the tooth. A condition such as is shown in Figure 5, *I,* may sometimes be found on the mesial or distal surfaces of a tooth, while at the same time a condition may be found on the labial or lingual surface such as is shown in Figure 5, *IV.*

At this time, it is appropriate to discuss the latest statements of Becks[3] on this subject. According to Becks, the detachment of the epithelium from the enamel progresses slowly to that point at which the bottom of the crevice reaches the cemento-enamel junction. Then, there is no more incentive for the epithelium to grow further apically; any further detachment of the epithelium from the root surface is due merely to pathologic influences. This opinion is in direct opposition to our findings. If the location of the bottom of the crevice on the cemento-enamel junction had any significance or if it were an intermission in the progress of the detachment, it would be a simple matter to find this condition frequently in a large number of specimens. Actualy, it is very seldom found in either man or animal. Even Becks, the originator of this theory, has not shown a single slide which demonstrates this location that he claims to be the border between the physiolgic and pathologic process. In his Figure 11, the bottom of the crevice is still on the enamel surface and not on the cemento-enamel junction; this photomicrograph, therefore, can by no means be used to illustrate Becks' contention. Another important argument against Becks' theory is the fact that never among the in-

Fig. 9.—Higher magnification of Figure 8. *E*, enamel rests; *E'*, deepest point of the enamel; *C*, cementum; *PC*, primary enamel cuticle; *SC'*, hornified secondary cuticle on the enamel; *SC"*, hornified secondary cuticle on the cementum; *Ep*, epithelial attachment consisting of large squamous epithelial cells. (×1,000.)

numerable human and animal teeth sectioned has there been found one in which the bottom of the crevice ran all around the cemento-enamel junction.

Since we have found no proofs for his arguments, our contention remains the same: The location of the bottom of the crevice at the cemento-enamel junction is merely a step in the continuous process of detachment without any practical or theoretical importance.

2. *Rodentia.*—The incisors of all rodent animals grow continuously; that is, the constant loss of tooth substance by abrasion at the occlusal surface is compensated for by the equally constant formation of new material at the apical tooth end. Consequently, teeth of this type develop no fixed apical foramen as do the teeth of men. The distribution of enamel and cementum in these teeth is as follows: On the labial (outer) surface, the entire length of the tooth is covered with enamel; while on the lingual (inner) side, the entire surface is covered with cementum. Thus, the cemento-enamel junction consists of two lines running lengthwise on the mesial and distal surfaces of the entire tooth. The relation of the mouth epithelium to this type of teeth is, therefore, sharply defined: On the labial surface throughout life, we find an epithelial attachment on the enamel, and on the lingual, an epithelial attachment on the cementum. Around the whole tooth, the deepest point of the epithelial attachment is continuously migrating toward the apical end as the tooth erupts. Accordingly, at the bottom of the gingival crevice, the epithelium is continuously detaching itself from the enamel on the labial side and from the cementum on the lingual side. Thus, a uniform length of clinical root and clinical crown is maintained despite the continuous growth. Almost identical conditions are found on the molars of some rodents, such as the rabbit and the guinea-pig.

3. *Herbivora.*—In this group of animals, represented by sheep, goats, cattle and others, the teeth have long enamel-covered crowns and relatively short roots. The root formation continues over a long period of time, and finally an apical foramen is formed. The most important peculiarity of these teeth is the fact that the entire enamel surface is covered with cementum, the enamel being exposed and visible only on the worn occlusal surface. The epithelial attachment, therefore, is always found on the cementum. It grows downward along the cementum and becomes detached from it at the bottom of the gingival crevice, the process being identical with that which occurs in older human beings, in whom a condition like that shown in Figure 4 and Figure 5, *IV*, is usually found.

WHAT DOES THE TERM "ATTACHMENT" MEAN?

In the beginning of this paper, I referred to the origin of the term "epithelial attachment" and tried to give an explanation of the meaning of it. I did this because much misunderstanding still prevails concerning the use of this term and the condition it implies. The status found in the teeth of young men, dogs, monkeys, etc., in which the epithelial attachment is entirely or almost entirely on the enamel, is still disputed. One of the objections given is that an "attachment" of epithelium to the smooth surface of the enamel does "not seem possible." To meet this objection, I wish to emphasize that it is not our aim to discuss "possibilities," but to show realities such as can be found on carefully prepared slides. The fact

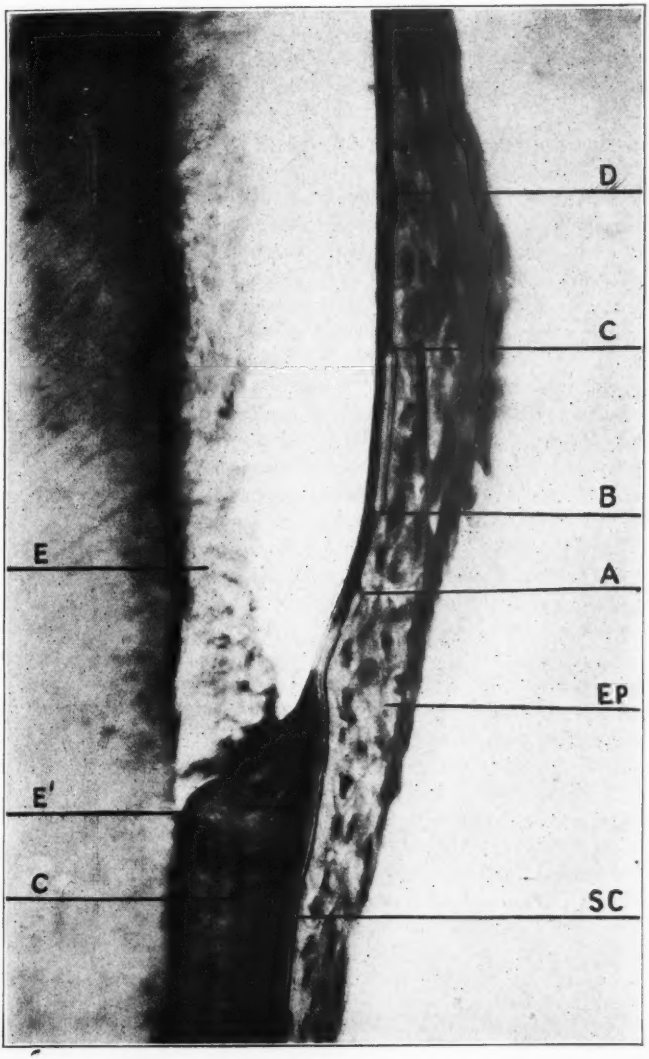

Fig. 10.—Another section of the tooth shown in Figures 7-9. *E*, enamel rests; *E'* deepest point of the enamel; *C*, cementum; *Ep*, epithelium of the epithelial attachment; *SC*, hornified secondary cuticle on the cementum; *A*, point to which hornification of the cuticle extends (from *A* to *B*, there is an interruption of the hornification); *B-C*, hornification of the secondary cuticle; *D*, very small isolated area of hornification. (×550.)

that the epithelium is directly attached to a calcified hard substance (tooth) is unique. This condition is not found elsewhere in the body. This, therefore, leaves little room for analogies or legitimate speculation.

In studying well-prepared material from young individuals, even after the loss of the enamel through decalcification, we are usually able to determine where the bottom of the gingival crevice terminated. We will also find that we can discriminate between the free epithelium lining the gingival crevice, and the epithelium as it develops, is united with the enamel, that is epithelial attachment. The border between these two is the bottom of the gingival crevice. Incisally from this point, the crown of the tooth is accessible to the influences of the oral cavity; apically, it is not. To illustrate this condition, I reproduce Figure 26 from the paper of Orban and Mueller.[2] (Fig. 6.) On the right side of this interdental space, we find the epithelium from *d* to *e* conforming to a smoothly curved line, the outline of the former enamel. This enamel was in organic connection with the epithelium. The bottom of the crevice was at *d*. From there on, upward, the free epithelium of the interdental papilla takes an irregular wavy course, which shows that it was free and unattached. Two things are attached to each other when it is not possible for anything to come between them except by traumatic separation. It is interesting to note that the calculus, *a*, stops exactly at *d;* this must, therefore, be the bottom of the crevice, because the calculus could go no deeper, as the attachment of the epithelium prevented this. Other factors in locating the bottom of the gingival crevice in the sections are: the location of the retro-epithelial and intra-epithelial infiltration (Orban and Mueller, Fig. 19[2]), and the presence and location of the enamel cuticle (Orban and Mueller [Figs. 19, 24, 25[2]] and others).

Another important objection brought up by practitioners is the fact that it is sometimes possible in young patients to penetrate with an explorer between the enamel and the epithelial attachment. As mentioned already, it is, of course, possible to separate by means of force two things that are attached. This does not prove that these things are not attached. The opinion has been expressed that the epithelium is not attached, but "adherent" to or "in close contact" with, the enamel. A distinction must be made between these terms. If a thing is "in close contact," it merely has a close physical but no organic connection. (When one's mouth is closed, the lips are "in close contact.") In histology, if a thing is attached or adherent, it is joined organically. Cells are attached to each other by protoplasmatic processes and can be separated only by trauma, and, in the same way, the epithelial attachment can be separated from the enamel by the force of an instrument.

Another method for discovering whether or not the epithelial attachment is "attached" to the enamel or merely in "close contact" is the study of the conditions found on extracted teeth. In extraction, the tissues are, as a rule, torn from the body wherever the least resistance is encountered. (We are, of course, speaking only about the tissues which come along "with the tooth," not of those which are occasionally caught by the forceps.) For instance, the fact that some alveolar bone comes out with an extracted tooth indicates that the connection of the tooth surface with the bone was stronger than the connection between the bone trabeculae. In extracting teeth

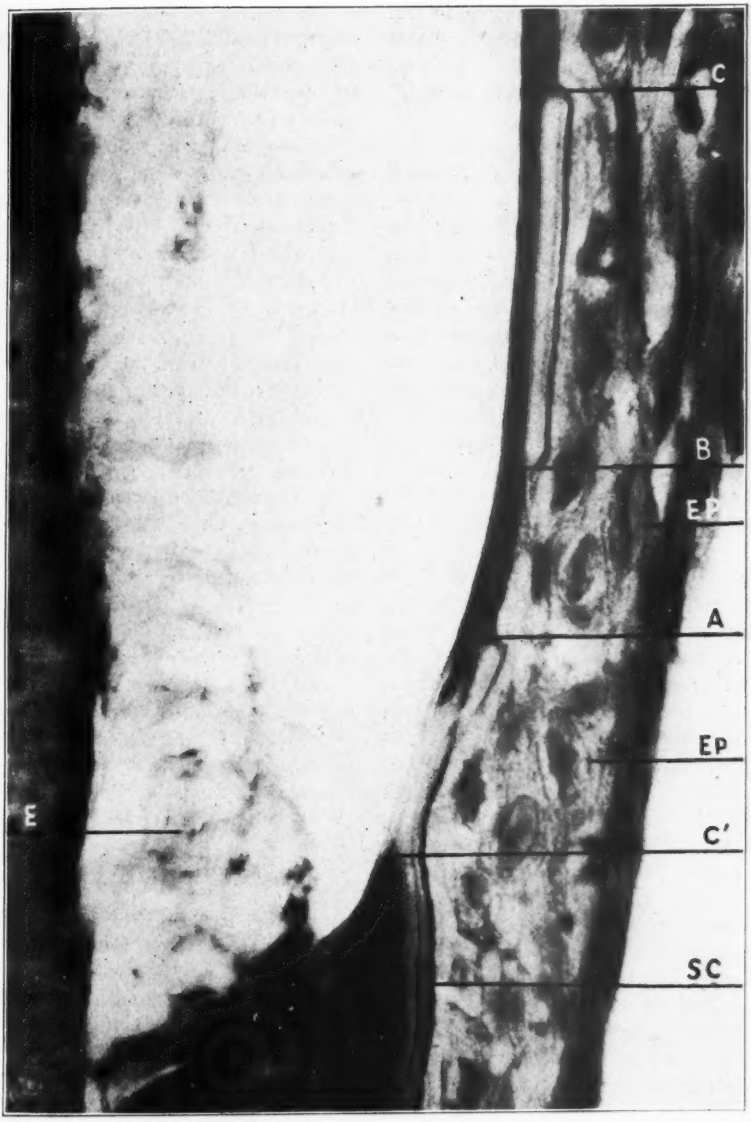

Fig. 11.—High magnification of Figure 10. *E*, enamel rests; *C'*, Highest point of the cementum; *SC*, hornified secondary cuticle on the cementum; *A*, abruptly ending hornification of the secondary cuticle (from *A* to *B*, there is a dark blue homogeneous layer on the enamel); *B-C*, partial hornification of the secondary cuticle; *Ep*, cells of the epithelial attachment.

of young people in whom the epithelium is still attached to a considerable extent to the enamel, the epithelial attachment can sometimes be found on the extracted tooth.

Figure 7 shows such a case. The photomicrograph was taken from the mesial side of a lower bicuspid extracted because of a large cavity. The forceps held the tooth labiolingually, and the area shown in Figure 7 was on the mesial side below the contact point and not touched by the forceps. Soft tissue, therefore, found in this location was strongly attached to the tooth surface. *D* is the dentin of this tooth, and, at *CA*, the gingival end of the carious area can be seen. The root surface is covered by a thin homogeneous layer of primary cementum, *C;* the enamel, *E*, is almost entirely lost by decalcification. On the surface of the enamel as well as the cementum, there is a thin layer of tissue, *T*, that evidently came along with the tooth during the extraction.

In a higher magnification of the cemento-enamel junction, it can be seen that this tissue on the outside of the tooth is epithelium (Fig. 8, *Ep*). Between this epithelium and the enamel there is a homogeneous layer, the secondary cuticle (*SC'*), stained yellowish red in the original slide. This hornified cuticle can be followed beyond the cemento-enamel junction, where it covers the surface of the cementum (*SC"*). Inside the cuticle on the enamel surface, there is a very thin dark cuticle to be seen at *PC*. This is the primary cuticle that was detached from the inside of the hornified secondary cuticle after the enamel was gone. Later on in this paper, I shall discuss in further detail the development and distribution of the cuticle. Here, I merely wish to call attention to the fact that the epithelial attachment is organically attached to the enamel surface. A still higher magnification (Fig. 9) plainly shows the structure of the large epithelial cells of the epithelial attachment. These cells have wavy outlines which interlace. This structural arrangement is typical of stratified squamous epithelium. In summarizing the findings, we can safely say that the attachment of the epithelium to the enamel and cementum was strong enough to hold during the extraction of the tooth.

The fact that caries is not found beyond the bottom of the crevice is also very important in this connection. As the epithelium is attached at the tooth surface above the cemento-enamel junction in young teeth, this area is protected and cannot decay. The latter fact has been described by G. V. Black.[6] In the case shown in Figure 7, the extracted tooth would show an area of healthy white enamel extending from the cemento-enamel junction, *CE*, up to the gingival border of the caries, *CA*. It is evident that this area was in connection with the epithelial attachment and was thus protected against outer influences, such as caries. The condition shown in Figure 7 is very similar to the one shown by Black in his book in Figure 138.

RELATION BETWEEN NASMYTH'S MEMBRANE AND THE EPITHELIAL ATTACHMENT

In the older publications on dental histology, Nasmyth's membrane is usually described as the thin remaining layer that covers the coronal portion of an extracted decalcified tooth. Many different descriptions have been given, and it has been suggested by almost all authorities working in this field that Nasmyth's membrane consists of two main

6. Black, G. V.: Operative Dentistry, Chicago: Vol. 1, 1908.

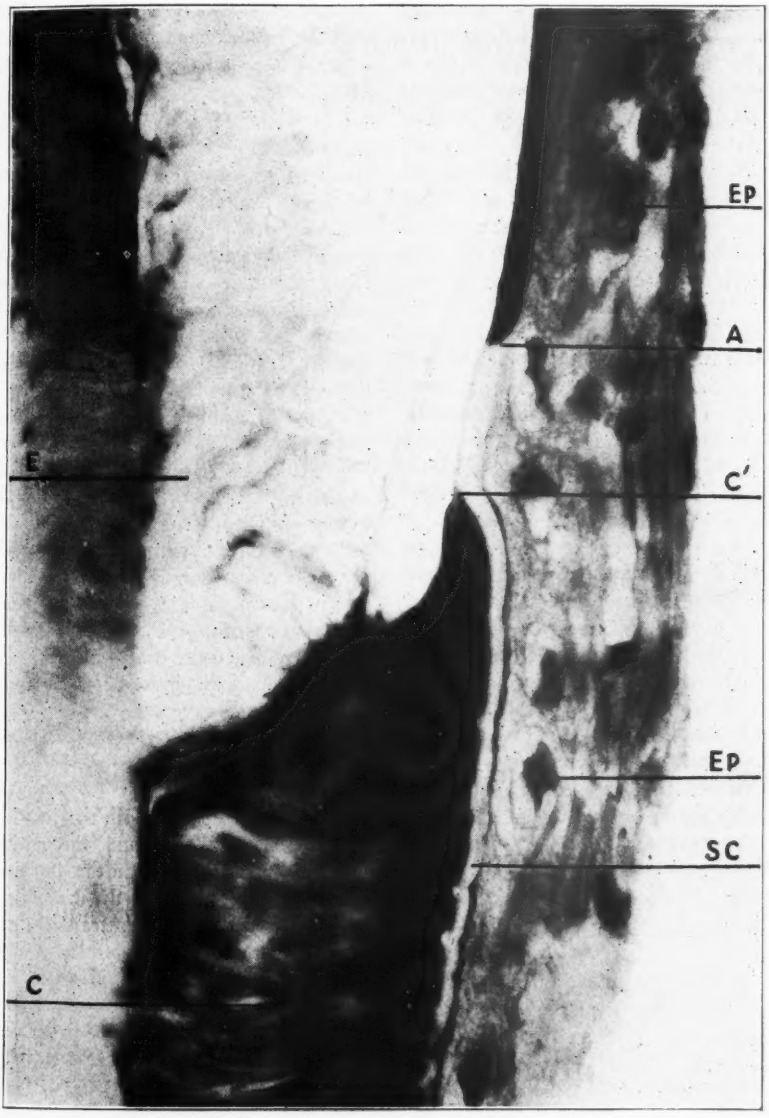

Fig. 12.—Another section through the cemento-enamel junction of the tooth shown in Figures 7-11. *E*, enamel; *C*, cementum; *SC*, hornified secondary cuticle on the cementum; *C'*, highest point of the cementum; *A*, end of the hornification of the cuticle; *Ep*, cells of the epithelial attachment. (×1,000.)

layers: an inner homogeneous, structureless, translucent layer, and an outer epithelial layer (Hopewell-Smith[7]). Quite recently, Gottlieb[8] has investigated the problem and has shown that the so-called epithelial part of Nasmyth's membrane is simply the epithelial attachment, and the inner part of Nasmyth's membrane is composed of two cuticular formations. He describes two types of cuticle: the primary and the secondary. The primary cuticle, the last product of the ameloblasts, is formed on the enamel surface before the ganoblasts degenerate and disappear. The primary cuticle is about 1 micron thick and very likely to calcify. In the event of calcification, it disappears with the enamel during decalcification. The secondary cuticle, a hornified product of the squamous cells of the epithelial attachment, is homogeneous, appears pink when stained with eosin, and is about 7 micra thick. Since it is deposited during the eruption of the tooth, the secondary cuticle can be found on the enamel as well as on the root surface and, therefore, has been called *cuticula dentis*. As it is very resistant to alkalis and acids, it is frequently found in decalcified sections. In the photographs shown above, both primary and secondary cuticle can be seen. In Figure 8, there are still some enamel rests left, and the primary cuticle, *PC*, has been separated from the hornified secondary cuticle, *SC'*. The secondary cuticle is covered by the cells of the epithelial attachment. In a higher magnification (Fig. 9), it can be seen how thin the primary cuticle, *PC*, is in comparison with the thick secondary cuticle, *SC*.

We now understand the origin of the old conception of Nasmyth's membrane. A tooth was extracted and decalcified, and the thin coat that came off by this procedure was spread on a slide and studied under the microscope. If this tooth was taken from a young person, a condition like that shown in Figure 7 could easily be found. When we imagine that the piece from *CE* upward to the carious area is looked at from the surface, we can differentiate two structures: epithelial cells corresponding to the part of the epithelial attachment that was adherent to the enamel, and a homogeneous cuticle that is the secondary cuticle. Thus, we get a picture like the one shown by Hopewell-Smith in Figure 2 of his book.[7] As Orban mentions in his book,[9] all the authors working in the field of Nasmyth's membrane did not know of the existence of an epithelial attachment, and therefore could not give sufficient explanation for the presence of these epithelial cells.

IRREGULARITIES OF THE HORNIFIED CUTICLE

In his paper dealing with the relationship of dental caries and the cuticle, Gottlieb[5] points out that the hornified cuticle does not necessarily develop on every tooth nor on the entire surface of any one tooth. He shows that on the circumference of one individual tooth, a hornified cuticle is present in only some areas and that this interrupted distribution contributes much to susceptibility to dental caries.

I wish to show with illustrations the variable appearance and distribution of

7. Hopewell-Smith, Arthur: Normal and Pathological Histology of the Mouth, Ed. 2, Philadelphia; P. Blakiston's Son and Co., 1918.

8. Gottlieb, Bernhard: Aetiologie und Prophylaxe der Zahnkaries. Ztschr. f. Stomatol., 1921, No. 3.

9. Orban, Balint: Dental Histology and Embryology, Ed. 2, Philadelphia; P. Blakiston's Son & Co., 1929, pp. 110-113.

the hornified cuticle. We see in Figure 8 that the hornified cuticle runs continuously over the cementum (*SC''*) as well as the enamel (*SC'*) and gradually increases in size as it nears the crown. Farther on in the same series, we come to sections in which the hornified cuticle is interrupted (Fig. 10). On the cementum surface, there is cuticle of the same appearance as that in Figure 8. This thick hornified cuticle ends shortly above the cemento-enamel junction. From there on, we see on the enamel merely a dark line extending to *B*. From here on to *C*, we see again a distinct, clear hornified cuticle. Above *C*, there is merely a dark structureless layer on the enamel, except the area *D*, where a very small area of hornification can be observed.

A higher magnification of the cemento-enamel junction (Fig. 11) reveals that the process of hornification terminates very abruptly at *A*. From *A* to *B*, there is a dark homogeneous structure lying between the epithelial attachment and the enamel surface. This dark layer is probably a product of degeneration of the inner cells of the epithelial attachment; perhaps a preliminary stage to hornification. From *B* to *C*, hornification again can be seen. This hornification has not gone so far as that from *C* to *A*. The part of the cuticle that lies in immediate contact with the enamel still appears dark blue; evidence that it was not yet completely hornified. A little farther on in the same series, we see the condition shown in Figure 12. A high power photograph of the cemento-enamel junction reveals the hornified cuticle covering the cementum. From there, it extends a short distance onto the enamel. At *A*, the hornification again suddenly terminates, and a dark blue unhornified layer is found covering the enamel surface.

These photomicrographs illustrate that the hornified cuticle is not always present. It may develop in some locations of the tooth surface, and may fail to develop in others. This fact is important, for when a tooth like the one from which Figures 7 and 10 were taken is erupting, areas of varying susceptibility to caries are exposed by the gradual separation of the epithelial attachment from the tooth surface. The hornified areas may resist decay; whereas, the unprotected areas may be highly susceptible to it.

OSTEOMYELITIS*

By T. A. HARDGROVE, Fond du Lac, Wis.

APPRECIATING the part he must take in the prevention and treatment of disease, and with a public growing more critical, owing to a better understanding of the ills to which they are heir, the dental practitioner finds that he must meet more and more exacting requirements. Not only must he understand how to prevent the diseases of the body, but he must also have a better understanding of a greater variety of them and a knowledge of their proper treatment, even though many times it does not fall within the scope of his

*Read before the Northern Illinois Dental Society, Oct. 23, 1929.

duties to accept responsibility for them. The practitioner should then have a more thorough understanding of all the normal tissues that he is called on to consider, as an aid to reasoning how and why certain disease phenomena manifest certain symptoms and pursue certain prescribed courses.

There is a sort of mechanics in all physiology and pathology as well; and particularly is that true when we are called on to consider diseases of the bone.

Osteomyelitis is one of the diseases with which we are confronted and which we have not always understood as well as we should. An understanding of it is important to the dentist because, many times, he is confronted with inflammation of the bone which does not act like the ordinary inflammation that he usually is called on to treat. His knowledge should enable him to make a differential diagnosis and to be able to determine whether a true osteomyelitis, an acute inflammation, an actual necrosis or some other inflammation of the bone is present.

An osteomyelitic condition can, by certain cardinal symptoms, be easily recognized. In order that the patient may receive the best possible results from our efforts, these symptoms should be recognized early. They are few in number, but of fundamental importance. One of the very early symptoms is pain, of a peculiar character. It persists in one locality in the beginning. The patient complains constantly of pain, and yet we do not see sufficient evidence to justify that complaint. Topical remedies afford only slight relief. The pain is due to the shutting off of the circulation of certain parts of the bone as a result of the invading infection. It is usually deep-seated, and there is an active exudate which causes the pressure on the nerve-endings. The unyielding nature of the bone, which cannot swell, plays its part in the production of pain.

Following that symptom and beginning about the same time, there is an elevation of the temperature, to no great height at first, and there may be quite an exaggeration of the pulse rate, which does not correspond exactly with the low temperature; also an increased leukocyte count, and following all of these symptoms, the beginning of the swelling, which may be delayed for a week. The swelling is of a different character from that caused by an abscess in that it sometimes affects the soft tissue over a larger area than one would expect in ordinary inflammation of the bone.

In osteomyelitis of the lower jaw, the swelling will extend in many directions. It may be high up as well as lower down and may extend backward to a line in front of the ear. The patient becomes alarmed about the condition and demands relief from the pain. He is not sick enough yet to realize that it requires patience to successfully treat a case of osteomyelitis.

The causative factor is, of course, bacterial. There is a persistent opinion that all osteomyelitis arises from some small abscess or pimple on the surface of the body. Gilmer, of Chicago, has called attention to that many times. The pus found in those cases is usually of the staphylococcus type. Sometimes, osteomyelitis may occur as the result of trauma or from bacterial invasion from the apices of teeth. Undoubtedly, in many cases, extraction of teeth has afforded drainage to an area that might have become affected with a serious osteomyelitis had the teeth not been extracted.

Osteomyelitis can occur also from other causes, as blastomycosis, or Vincent's infection can complicate an osteo-

myelitis, even if not directly responsible for it. We can differentiate between the osteomyelitis caused by staphylococcus and that due to blastomycetes, as the former is more active in its progress and causes the patient more pain and general discomfort.

The toxins arising from the staphylococcic osteomyelitis seem to be more virulent than those arising from the presence of blastomycetes or Vincent's infection. That can be explained from the fact that a blastomyces is a fungus organism and grows with less rapidity, less toxin formation and less immediate tissue destruction.

The Vincent organism is more or less local and does not seem to form toxins to the same extent, although there can be a greater leukocyte disturbance, the patient perhaps having a mononucelosis.

Osteomyelitic cases are not so innocuous that we may disregard them, but we should rather look on them as being capable of causing death, in some cases, in a very short time. This consideration should guide us in the management and treatment of these cases.

A patient with a staphylococcic osteomyelitis should be hospitalized as soon as the diagnosis is determined. The topical application for relief and to aid in the progress of the case is fomentation, but before this is applied, and as early as possible after the diagnosis is made, if we can determine about the place where the process is beginning to operate, a mucoperiosteal flap should be made so that several holes can be drilled down through to the locality of the inflammation. The hot fomentation will aid in reducing the inflammation and may sometimes actually terminate the disease before it makes any great headway.

If these holes are made early enough, they will drain the osteomyelitic area. If the process cannot be controlled and the circulation is arrested where the osteomyelitis is at work, the drain holes will not suffice. They will do no harm, because they may subsequently become the avenue through which the drainage is established. The case, then, if not yielding to this form of treatment, must go on without surgical interference until pus can be reached and drainage instituted.

No attempt should be made to remove sequestrated bone unless the sequestra are quite loose and can be easily removed. A statement has been made that it should be drained and not curetted. This is the point where danger is sometimes encountered, as the staphylococcus may get into the blood stream and end the patient's life. Some effort has been made to establish a standard for the length of time for the formation of sequestra, it being indicated that five weeks is a proper space of time to wait. That cannot be determined exactly as it is governed by the condition that arises and the patient's immunity and resistance to the infection.

As soon as we are satisfied that we can drain pus from a localized area, the effort should be made to do so, and we will probably be able, through the opening made, to determine, by the use of a sensitive engaging instrument, the location of forming sequestra. Thus, we can determine whether to attempt their removal at that time or whether we had better retain them longer. The involucrum is being formed, in all cases of osteomyelitis, in the presence of the sequestra, by the laying down of bone cells on the inner wall of the periosteum, and this progresses as the disease progresses, even more rapidly than one would anticipate. It seems to be encouraged by irrigation with antiseptic solutions, and if we are careful not to remove the sequestra too

early and permit the involucrum to act as a sort of splint and source of stimulation to any bone cells that are being laid down, it will become strong and well formed; and, in the case of the mandible, there will be no danger of pathologic fracture, so much dreaded, with its accompanying disfiguration.

The reason for delay is that we do not know to what extent the sequestra or necrotic bone is developing. We have seen the bone destroyed from the upper part of the ramus to the median line without any noticeable deformity when the case was terminated. We can even retain teeth that are loose, so loose that we feel an urge to remove them; but a test of these teeth should always be made to determine the vitality of the pulp. I do not believe it necessary to remove these teeth if they retain their vitality. The sequestra can be removed just the same, and new bone will be built around the roots of them; a refinement in the treatment of osteomyelitis that is peculiar and possible only, as I see it, to the dental profession, on account of their training.

In the blastomyces, we are confronted with an out of the ordinary cause for this disease, which is characterized by less pain and less swelling, and in which the swelling is liable to diminish or increase from one day to the next; while in the staphylococcic osteomyelitis, it is more lasting and more persistent, and the leukocyte count is not quite so high.

In a man referred for treatment, the condition was properly diagnosed as an osteomyelitis, but was not differentially diagnosed as an osteomyelitis due to blastomycetes. The tissue has been opened by the physician in an attempt to evacuate the pus, and some pus was draining when I first saw the case. I made a larger opening in an endeavor to obtain freer drainage. Even with that drainage, the case was not making the ordinary progress and was being dragged out over a longer period than an osteomyelitis should.

An examination of material washed out of the wound was made and it was found to contain blastomycetes. A satisfactory explanation then was had of the rather slow character of the disease and the lack of severe symptoms. In other words, its chronicity was explained.

We know that disease arising from blastomycetes requires different treatment from that caused by other organisms operating on the same tissue.

Drainage is essential, of course. It must be maintained even in these cases. The use of roentgen-ray therapy and administration of potassium iodid brought the case to a successful termination and prevented formation of further sequestra. Potassium iodid was not given in large doses, but over quite a period of time. Another condition found, which was new and justifies mention in this paper, can be best told of by the recital of an experience with another case of so-called osteomyelitis. The patient was a young woman who had an osteomyelitis, without differential diagnosis, which was acting somewhat like the one I have just recited, except that the examination of the material washed from the wound which had been made by a physician for the purpose of drainage revealed a chunky material which proved to be almost purely Vincent's spirochete. This was out of the ordinary, and a consideration as to whether it could be possible that it was a causative factor in the disease or a contaminating infection must be made. The patient's mouth was a clean one, with few decayed teeth and with practically no infection of the gin-

giva, which is so characteristic in a Vincent's infection.

The history of the case showed that it began with the use of a hypodermic needle in the region of the mental foramen. It is my impression that the Vincent organisms were carried deep into the tissue on the needle, which, if the organisms were on the tissue, might be expected and cannot always be prevented. Vincent's infection attacks the periosteum first and produces an osteomyelitis secondarily. When Vincent's infection is a factor, the periosteum must be incised so that the treatment can be made use of. Immediately on finding these organisms, I made use of the regular Vincent's treatment which had been successful in my hands. Taking a solution of chromic acid, I passed it from the opening in the mouth, down and out through the opening beneath the chin. Thereafter, hydrogen peroxid was used, which gave the desired reaction, and a very speedy termination of the disease without further sequestral formation occurred.

I mention that here for your consideration because it is worthy, I believe, of notation and it brings to light the fact that we must not be too much inclined to feel that, because certain things have been taken as the standard in particular diseases, we must adhere so strictly to them that our power of investigation will be handicapped. Strictly speaking, every form of bone inflammation is an osteomyelitis. There is no necessity for quibbling over terminology; the thing we wish to know is what the disease really is and the best way to cure it. There is a statement made that the term osteomyelitis should be used only where the bone had medullated canals.

All bones, whether long, flat or otherwise, have spaces in them which correspond to the medullated bone, and an inflammation of the bone always involves these spaces, because the bone itself, the stroma, so to speak, is not inflamed. It is the softer material in the bone that furnishes the bacterial pabulum at its own expense and feeds the bacteria that tear down the bone, incidentally, because of its presence in the locality. It seems sometimes that too great a distinction is made between periostitis and osteomyelitis. All inflammations of the bone are either preceded by an inflammation of the periosteum or are immediately associated with it. All forms of abscesses, whether having drainage openings or not, are a form of osteomyelitis and should be regarded as potential factors in the production of inflammation of the bone.

Osteomyelitis associated with fracture is an important consideration. All fractures produce inflammation of the bone, and in each case, there is formed an involucrum, which plays a part in the union of the fragments. I would like here to set down the principle that we have been keeping fractured bones immobilized too long. Any fracture that does not exhibit displacement and can be retained with a simple bandage without discomfort to the patient will get along better than if encumbered with an appliance. Some movement is not a handicap to the healing process of fractured bone, provided it does not cause displacement.

In many places where fractures occur in the body of the mandible, the muscle attachment is so arranged that retention is possible without fixed appliances. If we take a series of roentgenograms after noninfected fracture, we find that, in the first few weeks after the fracture, there seems to be a widening between the fragments and the material occupying that space does not calcify for many weeks and sometimes months after the

fracture occurs. It is a fibrous union, calcification coming afterwards.

Rest of the parts is essential. The diet is, of course, an important thing in every fracture. The food should afford calcific material, consisting of leafy vegetables, eggs and milk. Exposure to sunshine is beneficial. I have endeavored to shorten the time of calcification by the use of the violet ray, and I can say at this time that, even though the principle is correct, the effect was not readily noticeable.

CONCLUSIONS

1. The public is demanding a broader knowledge of a greater variety of diseases as well as a knowledge of their treatment, even though it does not fall within the scope of our duties to accept responsibility for them.

2. Physiology and pathology can be understood from a mechanical point of view, which is an assurance, after all, that the mechanically trained mind of the dentist should have no difficulty in understanding disease phenomena.

3. The symptoms of osteomyelitis, when well understood, will enable the practitioner to make an early diagnosis, and the making of a periosteal flap and drilling of holes in the bone to the point of inflammation, if done early enough, may establish drainage and terminate what might have been a prolonged case of osteomyelitis.

4. The pain associated with osteomyelitis is of a persistent character over quite a period before other symptoms confirming the diagnosis appear.

5. The temperature and pulse are apt not to be exaggerated in the same proportion in a case of osteomyelitis.

6. The swelling is of a different character from that seen in other conditions, being more nearly uniform over a greater area, and extending in many directions from the actual location of the disease.

7. More often than we anticipate, osteomyelitis arises from a small pimple or abscess on the surface of the body. Gilmer, of Chicago, called attention to this fact many years ago.

8. In many cases extraction of teeth has afforded drainage to an area that would have become osteomyelitic.

9. We have osteomyelitis as a result of blastomycosis occasionally, and Vincent's infection, more often than we anticipate, plays a part in osteomyelitis. The method of attack is through the peridental membrane and periosteum in the latter case.

10. While blastomycosis will yield to potassium iodid and roentgen-ray therapy, an osteomyelitis complicated by Vincent's infection will not yield to that treatment, but will yield to an 8 per cent solution of chromic acid followed by hydrogen peroxid, just as if the Vincent's infection were being treated around and about the teeth in the oral cavity.

11. Patients having osteomyelitis should be hospitalized if possible, the earlier, the better.

12. As soon as drainage can be established, a delicate engaging instrument should be made use of to determine the possible presence of sequestra.

13. Sequestra should not be removed until the involucrum is quite well established, so as to prevent disfiguration.

14. Not all teeth involved need necessarily be removed if the vitality of the pulp remains.

15. Pathologic fractures from an osteomyelitis of the mandible need not occur.

16. In all cases of osteomyelitis, we should make an early diagnosis and strive, if possible, to make a differential diagnosis, as this will aid us in the method of treatment. The three types of osteomyelitis referred to in this paper

require three different types of treatment, except that in all cases drainage is necessary.

17. All inflammations of the bone are osteomyelitic.

18. Osteomyelitis is present in the case of fractured bones, and the involucrum is laid down in case of fractures, on the periosteum, just as in the case of an osteomyelitis.

19. The material between the fractured ends of bone does not calcify for months in some cases, even though the patient may be using the jaw for mastication.

20. Some movement of the jaw is not a handicap to the healing process.

21. Many times, fractures are immobilized too long with a cumbersome appliance for the best interests of the healing process.

22. Diet and exposure to sunlight are of the greatest aid to the healing of fractures and in osteomyelitis.

IMPRESSIONS BASED ON CLINICAL OBSERVATIONS VS. SCIENTIFIC FACTS

By THADDEUS P. HYATT, D.D.S., F.A.C.D., New York City

IN the February issue of THE JOURNAL, page 349, is the following:

Mention has just been made of the necessity of giving attention to imperfections in the enamel, and this at once brings up the question of fissures and their treatment. During recent years, there has been in certain quarters a rather strong advocacy for the drilling out of every fissure in the tooth of a child as soon as the tooth is well through the gum, with the idea that these fissures are invariably an element of weakness and will ultimately lead to definite decay. I have never seen any reference whatever by the advocates of this practice to the question of susceptibility or immunity as a factor in deciding whether or not a fissure shall be drilled out and filled. In very susceptible mouths, no precaution is too great to protect the teeth against the progress of decay, and, in these mouths, a fissure in a tooth must always be looked on as a menace and should be cared for. Filling, of course, under these circumstances, is the most certain method of protecting the tooth, and, in extreme cases, there is no question of its desirability.

But in very many cases, I do not consider this practice justifiable if decay has not yet begun in the fissure. In children who are immune, or who promise an early immunity, I have never yet been able to bring myself to put a drill in an otherwise sound tooth and open a fissure. I have seen too many cases in which such teeth have gone without decay for a lifetime to justify me in anticipating trouble by drilling every fissure and inserting a filling. As I have intimated, I would base my decision largely on the evidence of susceptibility in that particular mouth.

To me, the most regrettable thing about this statement is the fact that, because of our love and admiration for the author, many will accept without question or investigation the advice he has given. A true friend does not fear the loss of affection and respect of one he differs with, and the conviction of a duty to my profession and my love for children impels me to reply.

Our profession will make but slow progress in the prevention of decay by operative procedure as long as we are willing to allow our thoughts to be influenced by clinical impressions. To re-

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fuse to accept carefully recorded facts when they differ from our own conclusions which are based on unrecorded clinical observations is to retard advancement along scientific lines.

The writer[1] states that there are some who believe it is good practice to cut out and fill every fissure "with the idea that these fissures are invariably an element of weakness and will ultimately lead to a definite decay." Those in "certain quarters" who advocate this procedure do so because sufficient scientific facts have been recorded to prove that over 95 per cent of these fissures do decay. (Propyhlactic odontotomy has never been offered as the "cure-all" or the all-preventive procedure, which will banish forever all dental troubles. Its supporters believe that it has its place and can play an important part in the broad program being slowly created for the control and prevention of dental caries.)

An examination has been made of 100 children between 6 and 7 years of age who had all four first permanent molars present and all noncarious. It was found that 352, or 88 per cent, of these molars had occlusal precarious pits and fissures.

When the statement was made in 1923 that thousands of adults between 30 and 40 years of age had many molars with occlusal pits and fissures which had not decayed, an examination was made of 145 adults between 30 and 40 years of age to ascertain the facts. (These were not selected cases.)

The conditions of all first and second molars were recorded. If none of these molars had been lost, there would be 1,160 molars present. Let us assume that when these molars erupted, they had the same percentage of occlusal pits and fissures as were found in the 100 children examined. (This is conservative, because the 100 children were selected because they had no caries anywhere in the mouth.)

Thus, there were 1,021 molars with occlusal fissures and 139 molars without occlusal fissures. The examination showed that, in these 145 adults, there were only eleven molars with noncarious occlusal surfaces with fissures, and eighty-nine molars with noncarious occlusal surfaces with no fissures.

Of the 1,060 other molars, 482 had been lost, 488 had occlusal fillings and ninety had occlusal carious cavities. Assuming that these teeth had the usual percentage of occlusal fissures, we find that thirty-six per cent of nonfissured occlusal surfaces had decayed, while 64 per cent had not decayed, since there are eighty-nine left of the 139. On the other hand, 99 per cent of fissured occlusal surfaces had decayed and 1 per cent had not decayed, since there were only eleven left of the 1,021.

While this is interesting and very significant, what are the actual facts? In these 145 adults between 30 and 40 years, we found only eleven molars having occlusal fissures. This is not an opinion based on empiric clinical observations, but the result of accurately recorded facts. It is quite evident that while it is true that occasionally we will find occlusal fissures in adults around 40 years of age, such cases are so rare as to constitute the exceptions which prove the rule. Is it wise or is it desirable to advocate a procedure which is based on exceptions and contrary to scientific facts?

We regret that the writer of the article quoted did not give us any facts or figures to substantiate scientifically the statement that he has seen many fissured teeth that did not decay for a lifetime. We would

1. Johnson, C. N.: Preventive Dentistry; Its Scope and Possibilities, 17: 349 (Feb.) 1930.

like to accept the writer's opinion, but regret that we cannot do so when carefully recorded facts give such a very different picture of what the actual conditions are.

The writer also states, "I have never yet been able to bring myself to put a drill in an otherwise sound tooth and open a fissure."

Clinical examination of a fissure shows only a small opening in the enamel. We have no means at present of telling how far this opening penetrates into the tooth. We cannot tell whether at the base decay had already started. Therefore, it is impossible for any one to tell scientifically whether the fissured tooth is "otherwise sound." As it is the common experience of many to find extensive decay (often to their great surprise) when opening the smallest fissure, is it wise to assume that the tooth is "otherwise sound" when we have no actual knowledge of what the condition is at the base of the fissure?

Every fissure because of its shape, particularly when located in the occlusal surface of a tooth, is liable to decay. Why? Because it is impossible to keep it clean. With an absolutely controlled diet and proper health habits, it may not be even necessary to brush the teeth. But this is pure speculation. It is not scientific. We are compelled to deal with conditions as we find them.

The writer speaks of children "who promise an early immunity." I have yet to meet the physician or dentist who is able to elucidate or describe the symptoms which foretell "an early immunity."

We regret that the writer did not tell us what the signs are which foretell future immunity. It is true that "the evidences of susceptibility are so plainly apparent that 'he who runs may read' "; but who is able to delve into the future and to state scientifically that, in this particular case, these fissures will not decay because of the promise of an early immunity?

From the study of facts collected from examinations of more than 4,000,000 surfaces of teeth, mathematicians have calculated that the chances are 2,500 to 1 that a pit or fissure will decay in less than ten years. (I am not a mathematician but I have been able to secure the assistance of very able and competent professional mathematicians.)

Where is the man with such omnipotent foresight that he is able to diagnose which one of the pits or fissures of the 2,500 will not be liable to caries within ten years? In our present state of civilization, who can tell which child will maintain such a high degree of mouth cleanliness and mouth immunity that it will avoid any possible danger from the fermentation of carbohydrates and bacterial growth in undisturbed retentive places?

Every little cavity in the enamel of a tooth, be it carious or noncarious, is an ever-present potential danger to that tooth. The immunity or susceptibility of the child may vary, but the vulnerability and liability of these little holes to caries is always present. It is not the dentist who is taking chances (I would not care so much if it were) of decay undermining the enamel protection of his teeth, but his little patient, who cannot help himself.

To make a little "hole no hole" by the aid of a "pinhole filling" is to increase the chances of early immunity and to protect the tooth when the period of susceptibility arrives.

We have no right to speculate with the "may be" or the "might be" when dealing with so important a matter as the health of the child. In the days gone by, we did not realize the importance of mouth health, and took chances and made

guesses which are not justified today with our present knowledge of scientific facts.

All my children were vaccinated, not because they were ill, not because they might become ill, but as a conservative and scientific preventive procedure. The medical profession apply other preventive procedures to hundreds of thousands of children regardless of any "promise of early immunity."

When our profession is prepared to follow this splendid and enlightened example and practice preventive procedure, regardless of any "promise of early immunity," then will it be able to take its rightful place as a noble and intelligent protector of human health and happiness.

[To all of which and without further argument, the author of the paper quoted still stands on the statements made therein, the advocates of "prophylactic odontotomy" to the contrary notwithstanding. And as for evidence, he would much prefer clinical experience (not "impressions"—a term introduced by Dr. Hyatt) to all the statistics that might be collected on the subject, even with the assistance of some "very able and competent professional mathematicians."—C. N. J.]

DOES THE AMERICAN DENTAL ASSOCIATION NEED A HOME OF ITS OWN?*

By C. N. JOHNSON, L.D.S., D.D.S., Chicago, Ill.

I MUST first express myself as deeply grateful to your program committee for giving me the title of this paper. The idea of a home for the American Dental Association has been a pet hobby with me for many years. In the February, 1929, issue of THE JOURNAL, I had an editorial on this subject, and from that date on, my interest has never wavered. I am happy to say that one result of the agitation for a home has been to bring to our organization the promise of a nucleus of a fund for this purpose from an outside source, and the prospect is good for additional acquisitions as the plan takes definite shape and as more individuals are made acquainted with our purpose.

With the indulgence of your society, I should like to repeat at this time the text of the editorial for the benefit of those who did not chance to see it, and because it contains the essence of the argument that I wish to present today. This is a subject that is of vital interest to every member of our organization, and the men and women of Michigan are equally concerned with those members from every other state of the Union. The editorial reads as follows:

> There is nothing that adds more to the material stability of an individual than to own a home of his own. It constitutes him at once an integral unit in the community, and gives him more self respect. Not only that, but it creates respect on the part of others. To call a man a householder is to add to his prestige among the people, to give him an established status, and to classify him as a responsible citizen.

*Read before the Michigan State Dental Society, May, 1930.

What is true of individuals is largely true of associations. The moment any association establishes itself in a house of its own, it takes on a standing and a dignity that is never possible as long as it leases its quarters and pays rent to a landlord. In a certain sense, paying rent is an extravagance. The statement is sometimes made that it is cheaper for an individual to pay rent than to own his own home, and figures are adduced to prove it. This is only in line with the fact that you can prove almost anything with figures, but actual experience often discounts the findings of figures; and usually the owning of a home is found to be an asset rather than a liability. Most professional men who have accumulated a competence have owned their homes.

If the American Dental Association had secured a home of its own some time ago, the rent that it has paid would have gone a long way toward helping to pay for the home. The time has now arrived when our Association should begin to think seriously on this matter. The American Medical Association has owned its home for some time, and this is one of the best investments that it has ever made, establishing it in the professional and public mind as nothing else could have done.

Our Association is developing so rapidly that the need for a home is growing more urgent every day. Even with enlarged quarters, we are becoming more crowded all the while, and crowding in an office like ours is not conducive to the best service. When we secured a chemist to investigate the various products that are offered the profession and the public, it was necessary to house him in the chemical laboratory of the American Medical Association, and our organization is under a lasting obligation to the A. M. A. for the courtesy thus extended to us. Without this courtesy, we would have been helpless, because we assuredly have no facilities or space to accommodate a chemist. When the A. M. A. very generously invited our chemist to do this work in their laboratory and placed their facilities at his disposal, they solved this one problem for us at least temporarily; but as the work expands, more room will be needed. Not only that, but other departments are growing continuously, and if they were not, we would be falling short of the manifest and necessary development of the organization. From every point of view, a permanent home is needed for our Association, and the sooner we begin to plan for it, the better.

The first and natural question to be raised is the possibility of financing such a plan, but this need not make us hesitate a moment. With the brains in our organization, an enterprise like this can be financed without question. We already have certain assets that might be made available, and then, by strict economy in the management of the Association, it would not take long to pay for a home. The main thing is to begin to plan at once and secure property, vacant or otherwise, before values advance to prohibitive proportions. If a little farsightedness is used, it will be possible to procure property in a locality where values are increasing in such a way as to prove extremely profitable to the Association even as an investment.

We commend this idea to the consideration of our Board of Trustees and our House of Delegates, with the hope that they may think favorably of it and begin to take steps to bring about its consummation. It will mean more for the welfare of the Association than anything that has happened in its history.

Shortly after the appearance of this editorial, the editor was approached by a member of the Dental Alliance, a body organized for the purpose of contesting process patents in dentistry, and the intimation was made that in view of the fact that there was little prospect of any suits developing in connection with this question for a very long time at least, and probably for all time, there might be a likelihood that the funds remaining in the treasury, amounting to about $12,000, could be turned over to the American Dental Association as the nucleus of a building fund.

When this matter was brought to the attention of the Board of Trustees of the A. D. A., a committee was appointed to confer with the officials of the Alliance with the object of formulating a plan whereby the transfer of funds might be equitably brought about, and the conferences have now proceeded to the point where a practical agreement has been

reached which it is hoped will appeal to all parties concerned when the matter is brought to the attention of the Board of Trustees and from them to the House of Delegates at the Denver meeting in July.

It would be premature to discuss at this time the details of such an agreement as this, but it can be said with confidence that when the final plan is consummated, it will be found equitable in every way and advantageous to all parties concerned. On the present occasion, it is merely necessary to state that the acquisition of this sum as a concrete beginning lends definiteness and stability to the idea of a permanent home for our organization. As has just been said, the American Dental Association is as much a Michigan enterprise as it is that of any single state, and what concerns one state concerns all of them.

For the benefit of those who are not familiar with the affairs of our organization as represented by the activities in the Central Office, it may be desirable to discuss briefly the conditions which confront us today in trying to carry on the routine business of the Association in our present environment. We are housed in a building where the rent is not considered excessive, and yet it is becoming very costly. Our different departments are growing so rapidly in the volume of work they are called on to do that we are getting more and more crowded, and are obliged from time to time to take on additional space. Not only that, but new departments and new activities are constantly being added; all of which creates an inevitable demand for greater space. The point is being approached where our rent is becoming a very important item of expense; in fact, it constitutes itself almost a burden.

It is only a few years since the Library Bureau was organized, and today it has grown to such proportions in books and reprints that a great deal of its material has to be stored in the basement of the building, which is of course extremely inconvenient. Material of this kind takes up much room, and a certain proportion must be kept conveniently at hand for constant use. It would be a revelation to most of our members to see the volume of material that is continually going through the hands of our Librarian in the way of loaned books and package libraries. The service is growing by leaps and bounds, and it is absolutely necessary to keep increasing the space for its accommodation. In a building of our own, this additional space would not mean much in the way of expense, but every added foot in rent mounts up.

The Department of Dental Health Education is another enterprise that of necessity requires much space for its various activities, and no one who is familiar with its functions would care to see it discontinued or in any way hampered in its service. While it has been in operation only a comparatively few years, it has made a place for itself in the Association machinery that renders it a practical necessity.

The organization in January, 1930, of the new Council on Dental Therapeutics will mean another demand for space. Already the secretary of the Council is established in the Central Office with desk, stenographer and filing cabinet, and the prospect is good for a very extended service in this department. As it stands at present, this Council meets in quarters furnished through the courtesy of the American Medical Association at its headquarters, and while we must, as has already been intimated, express our keen appreciation to the A. M. A. for housing

our Bureau of Chemistry and furnishing a meeting place for our Council on Dental Therapeutics, I personally must confess to a sense of embarrassment, and even humiliation, to think that an organization of between 30,000 and 40,000 members such as we have today should find itself reduced to the necessity of accepting such a privilege from a sister organization. The time has come for us to throw off our swaddling clothes and begin to walk by ourselves. Most of our work in the Central Office might be performed with greater expedition and assuredly with more comfort if we had more room at our command. But this must not be taken as in any way a complaint on the part of those who work in that office. I think that I represent the true state of affairs when I affirm that there never was an organization more fortunate than ours in the personnel of its staff of workers. There is a loyalty and a devotion to the best interests of the Association on the part of those employed in the Central Office that contributes in a very concrete way to the efficiency of the service dispensed, and our greatest regret is that more of our members do not visit the office and make note of the things that we are trying to do on behalf of organized dentistry. We would welcome at any time concrete and helpful suggestions from our members for the betterment of the service and for a wider range of usefulness.

But our organization will never come fully into the fruition of its most cherished ideals till it is housed in a home of its own. To own its own home contributes stability and lends dignity and influence to any organization. The moment our members know that we have a home where all of our activities center, a place to which they can come, a place to call their very own, they will at once take a greater pride in the institution. It will be something concrete to bind the organization together in a greater unity of purpose. Not only that, but the effect on the outside world will be very salutary. We shall then be looked on as a responsible organization worthy of the respect of all thinking people, and our status in the community will be raised immeasurably. In every conceivable way, the advantages are all in favor of acquiring a home and doing it in the immediate future. The time just now is very propitious. There has been a very manifest stringency in the real estate market, and suitable property may be secured just now on the most favorable terms; on terms that probably cannot be duplicated for years to come, and probably never can be duplicated. The time must inevitably arrive when we shall be obliged to secure a home of our own, and if we procrastinate, we shall quite likely pay very dearly for it.

WAYS AND MEANS

The question that will probably arise in the minds of many of our members is the problem of financing such an enterprise. We realize that the initial sum of $12,000 will not go very far toward paying for a piece of property of this magnitude, but it is a very respectable start toward a first payment, and as has just been intimated, there is no doubt that other sums may come to us as soon as the enterprise is definitely assured. "Nothing succeeds like success," and the main thing is to make the first move toward consummating the project. Even if no other voluntary contributions come in, there need be no question about the ability of the organization to finance such a plan. I have consulted with our Business Manager and he assures me that, with a little foresight and acumen, there will be no difficulty in handling the financial end.

We have some resources in the organization which have been accumulated in the course of the years, and while the different funds as at present constituted are allotted to definite departments, and no provision has yet been made for building purposes, these funds must be looked on as concrete assets of the Association, and may at least be made available if necessary for security.

And there is this additional feature which must appeal to all of those who are keenly interested in the welfare of the organization: The moment that a decision is made to invest in a home, our various committees and our members generally will voluntarily wish to economize in every way possible in handling the affairs of the Association. There will then be an incentive to save that has never before been manifest; in fact, it may be said that it will be necessary to save, and this always has a salutary effect on the *morale* of an organization or an individual. It is not telling tales out of school to say that in the past some of our committees have not felt it necessary to conserve the funds of the Association as carefully as they might, and this is only in line with the common tendencies of human nature. It is the most natural thing in the world for men to be liberal and even careless in the expenditure of money that does not belong to them personally, and especially if it belongs to an organization from which they readily eliminate the personal element. A little salutary economy all along the line will not hurt our Association in the least; on the contrary, it will be most beneficial, and this need not in any degree detract from the most efficient service to the organization.

Extravagant habits are as likely to creep into an organization as they are to affect an individual, and it need not be considered a reflection on any one to say that, in the past, a considerable amount of the Association funds has been spent without commensurate benefit to the organization. It must be recognized, of course, that it requires money to pay the legitimate expenses of an association of more than 34,000 members and to give them the service to which they are entitled, and I am very sure that not one of our members will ever begrudge any necessary expense that redounds to the advantage of the organization; but I must say, in all sincerity, that some of us who have for years been close to the Association and genuinely interested in its welfare and who have economized in every possible way for its benefit have, at times, been somewhat disconcerted and even discouraged to see the funds used with greater liberality than was justified by the resultant good that was brought to the organization.

It may be said to the credit of our Board of Trustees and to the House of Delegates that they have always, on the one hand, been most generous in the support of all laudable enterprises and, on the other, they have ever sought to conserve the resources of the Association in every legitimate way in their power. The financial standing of the organization today and the amount of service that it has dispensed in the years of its existence furnish abundant evidence of the integrity and wisdom of these two bodies, and all that remains is the necessity of a slight tightening up of some of the loose ends of expenditure that have been allowed to drift without much consideration on the part of anyone.

Nothing will make an individual or an organization check up on expenditures like an obligation that must be met, and there is no other incentive to save quite equal to that of paying for a home. This

matter has been considered for some time in the Central Office, and if the proper steps are taken by the bodies in authority at this coming meeting in Denver, we are ready to go ahead and bring the matter to a concrete conclusion at the earliest possible moment. And when this shall eventually have been brought about, I predict for our organization an accession of interest that has never been approached in the past. It is the one remaining thing necessary to give us a status that we have never before dreamed of.

The American Dental Association has extended its vision very greatly in recent years. It has made contacts with many of the other national welfare organizations, and it is becoming known as a real factor in the conservation of the health of the people. More and more, it is engaged in true philanthropic service, and it is instrumental in placing dentistry on the map of the professional world. It is rapidly taking its place beside the other great professional organizations of this and other countries. No one who is not connected with its central activities can conceive of its rapid development, and each succeeding year brings to it added achievement, prestige and responsibility. It has a mission to serve in the development of dentistry second to that of no other organization in the world, and it will require all the brains and all the devotion of every one of its members to bring to its fullest fruition the possibilities that lie before it. No narrowness of vision must be permitted to mar its prospect. Every member must accept his obligation as something concrete and very serious.

The Association will not run itself. Its very momentum involves the necessity for the most careful and able guidance, and for this purpose, the combined intelligence of its officers and members will be found none too great. Every agency connected with it must be mobilized for the common good of the organization. As I view it, the approaching years of the immediate future will mean much for the weal or wo of the Association, and I am more than ordinarily anxious to see that every step now being made will be one of advancement. The increasing number of its activities are daily adding to its problems, and it will require the enlistment of every reserve of intellect and devotion to stabilize its progress and bring its various enterprises to the fullest fruition.

Toward this end, there is needed a new consecration and a new spirit on the part of its members. The life of the organization is the life of its members, and without the proper spirit, no organization can exist and function properly. Sometimes, a material achievement may contribute to a spiritual uplift, and of all the material agencies at our present command I know of none which can compare in possibilities with that of acquiring and occupying a home of our own. To this fortunate consummation, let us all labor; for let it be repeated that as far as the American Dental Association is concerned, what is good for the organization as a whole is good for the individual states, and this means in a very intimate and concrete sense the State of Michigan as well as every other.

CARCINOMA OF THE ORAL CAVITY*

By LESTER HOLLANDER, M.D., Pittsburgh, Pa.

MY presentation of carcinoma of the oral cavity will tend to be of the most practical kind, and it aims to bring about a better understanding between you who look at it from the standpoint of the dental surgeon and myself, a dermatologist interested in carcinoma of the mucous membranes. A better understanding is necessary if the patients who suffer with this death-bearing disease are to be benefited in the long run, for the key to the situation is more in the domain of prevention, which is within the province of the dental surgeon, than it is in the carrying out of the actual therapy, once the disease has made its appearance.

I make this assertion because I contend that oral sepsis plays an important rôle in the production of carcinoma in the oral cavity.

GENERAL CONSIDERATIONS ABOUT CARCINOMA

It might be of interest to quote W. S. Handley,[1] of the Cancer Research Division of the Middlesex Hospital of London, in presenting an intimate interpretation of what cancer is. He sums it up in the following quotation:

> Certain forms of chronic irritation, or, what often comes to the same thing, certain forms of bacterial infection of the tissues of the body, are likely to lead to the production of a cancer. How this comes about is still unknown. It is to be inferred that man, with his millions of cells, has evolved from a single cell. It is hardly a matter of surprise if, occasionally, one of these millions of trained, subordinate cells reverts to the ancestral independent type and behaves as an uncontrolled organism, owing no allegiance to the cell unit whose ruin is the final outcome.
>
> It is known also that a living organism, though as a rule it breeds true to type, may occasionally produce an offspring which varies inexplicably from the parent organism in one or more of its characters. The cancer cell, with its remorseless power of self-multiplication, obtained by the abandonment of other and useful functions, may be a biological sport or variation of spontaneous occurrence.
>
> We do not know why the unicellular organism evolved into the multicellular animal, nor why the unicellular ovum produced the multicellular man. The converse problem—that of the origin of cancer, is equally obscure.

A great many attempts have been made to clarify the status of carcinoma, to get at its etiology. Most of the avenues have led out from the laboratory: studies of cellular composition of tumors, biochemical investigations, studies of cellular resistance to physical and mechanical agents, bacteriologic researches, observations in heredity, etc., have all found ardent workers, but as yet nothing sufficiently definite in the form of conclusions has been reached.

In this presentation, I wish to emphasize the biologic factors in the development of carcinoma, to put before you in a clinical way where carcinoma is found, in what type of patient, in what kind of a mouth; or, more specifically, I will

*Read before the American Dental Association, Washington, D. C., October, 1929.

1. Handley, W. S.: Cancer Research at the Middlesex Hospital, 1900-1924, London: John Murray, 1924, p. 5-6.

consider the patient who harbors carcinoma and see if anything illuminating can be found. In order to do this, let us summarize what is known in a practical way about carcinoma:

It is recognized that, in its incipiency, cancer is a local disease. It is recognized that no matter where cancer occurs, its biologic unit is a cell which does not conform with our conception of a well-regulated, mature, anatomic unit which performs a necessary function in the body economy. It is recognized microscopically that the relation of the tumor cells to the adjacent tissue is most characteristic, not being bounded by a line of demarcation from the connective tissue. Instead, the cells grow irregularly and push their way into that tissue. It is recognized that this condition, no matter where it occurs, has the same destructive effect on the surrounding structures and the same poisonous effect on the entire organism, through the dissemination of the obnoxious toxins which are created by lytic changes within and surrounding the tumor. It is recognized that the frequency of its occurrence seems to be in locations which are subjected to more frequent trauma of mechanical, physical, bacteriologic or chemical nature than are other portions of the body. It is recognized that dissemination occurs through extension into the surrounding structures and through the lymphatic channels into the lymphatic glands and distant organs. It is also recognized that this new formation strikes at a certain period of life which seems to coincide with senescence.

Fig. 1.—Dermatitis seborrhoeica of the lip.

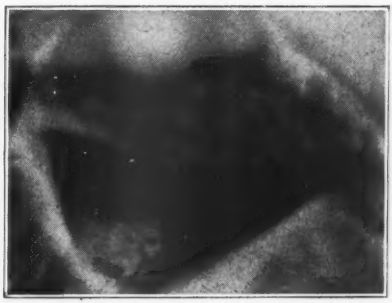

Fig. 2.—Leukoplakia buccalis.

GENERAL CONSIDERATIONS ABOUT CARCINOMA OF THE ORAL CAVITY

It is recognized that, on the skin at least, carcinoma develops most frequently upon the site of a preexisting dermatologic defect: nevus, scar, tuberculosis, keratosis, etc.; although little has been said on this subject, except in the case of leukoplakia. A similar condition exists in the mucous membrane, for the development of carcinoma occurs on patches of seborrheic dermatitis, areas of glossitis (chronic) and ulcerative areas about the gingiva. These frequently escape the attention of practitioners. It is in this connection that preventive work can be accomplished.

Innumerable examples have been used to show that chronic irritation plays a definite rôle in carcinoma production, but the irritants pointed out were mostly of mechanical or physical nature. In carcinoma of the mouth, one is impressed with

the fact that almost uniformly the patients have a septic mouth, and that mucous membrane defects in the presence of microbic irritation, coming from periodontitis in its various stages, seem to be the criteria necessary for the production of carcinoma of the mucous membrane.

The literature offers a number of notations of keen observers on the point of dental caries in association with carcinoma of the oral cavity.

Ewing[2] says: "Among preventable cancers, the most obvious is the intra-oral group. Cancers of the lip, tongue and tonsil are due to bad teeth, tobacco and syphilis, in the order named. Broken, decayed and projecting teeth continually tear the adjacent mucosa. Pyorrhea often adds an effective irritant. Buccal uncleanliness is of great importance."

Fig. 3.—Carcinoma of the lip, superficial papillary type, with encrustation of lesion and septic mouth.

Dobson[3] emphasizes "the importance of lack of dental cleanliness as a contributory factor in carcinoma of the mouth."

Schempp[4] considers "dental caries, smoking and leukoplakia as predisposing causes."

Duncan Fitzwilliams[5] states: "My dentist once asked me if I had ever seen cancer of the tongue in an edentulous person. The thought had never occurred to me before and I had to confess I could not recall a single case. Many had been sent to have their teeth seen to as soon as they were examined and since then I have noted bad teeth in almost every case. Probably nowhere in the body are the tissues subject to the influence of sepsis so continually as they are in the mouth of the poorer classes of patients."

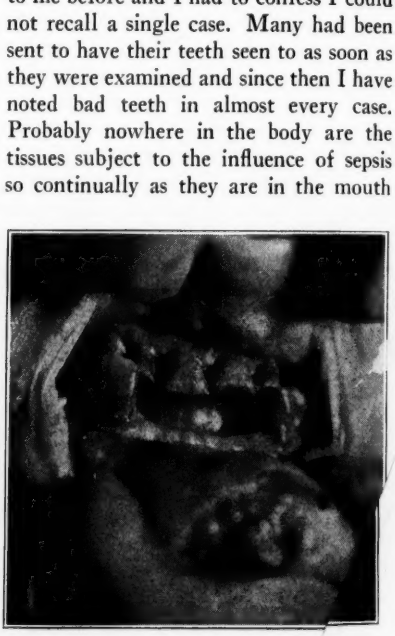

Fig. 4.—Carcinoma of the lip. Characteristic hardness is elicited by palpation and the mouth is septic.

Moorehead and Dewey[6] quote Bashford, who believes "that carcinoma biologically is a function incident to the decay of tissues."

2. Ewing, James: Neoplastic Diseases, Ed. 3, Philadelphia: W. B. Saunders Co., 1928, p. 885.

3. Dobson: Cancer Rev., 4:21, 1929.

4. Schempp, E.: Cancer Rev., 1: 398, 1926.

5. Fitzwilliams, D. C. L.: Tongue and Its Diseases, New York: Oxford University Press, 1927, p. 371.

6. Moorehead, F. B., and Dewey, Kathe W.: Pathology of the Mouth, Philadelphia: W. B. Saunders Co., 1925, p. 389.

Arthur Hopewell-Smith[7] puts it as "physiological resistance reduced through infection about the alveolar process."

Much has been said of pressure sores caused by ill-fitting dentures, as a factor in carcinoma. My experience has been entirely different. During the last two years, I have had the opportunity to examine edentulous patients in the office of H. J. Horner. Some of these patients came in from other offices with evil-looking deep ulcers resulting from the pressure of ill-fitting dentures, and some of the ulcers have lasted over an extended period of time. So far, I have not seen a single one of these become carcinomatous

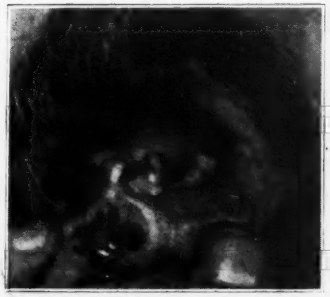

Fig. 5.—Carcinoma of the lip, with extension into the surrounding structure and oral sepsis.

if the patient has been edentulous for a period of one year or over. Let us remember that roots may be present. If there is any doubt, roentgen-ray examination of the mouth is advised.

PRECANCEROUS LESIONS AND ORAL SEPSIS

As stated before, the contention seems true that carcinoma of the oral cavity begins as a local disease, and, as such, should lend itself admirably to preventive measures. It is within the domain of the general dental profession, more than within the scope of any other practitioner of medicine or any specialist, that the earliest observations can be made. There are three points to bear in mind:

1. Preexisting anatomic (structural) defects of the mucous membrane. These are sometimes referred to as premalignant or precancerous lesions: (a) Dermatitis seborrhoeica or cheilitis exfoliativa, or persistent exfoliation of the lips.[8] This is a

Fig. 6.—Carcinoma of the upper lip, with degenerative changes, ulceration and mouth sepsis.

chronic inflammatory disease of the mucous membrane of the lips characterized by the formation of crusts and scales, limited to the vermilion border of the lips. These are of varying thickness. Crusts, which are usually dark yellow and occur in heaped up masses, causing bleeding and

7. Hopewell-Smith, Arthur: Normal and Pathological Histology of the Mouth, Vol. 2, Philadelphia: P. Blakiston's Sons & Co., 1928, p. 269.

8. Ormsby, O. S.: Diseases of the Skin, Philadelphia: Lea & Febiger, 1927, pp. 1220-1221.

fissuration on removal, form, exfoliate and reform again. The lips are usually tender. (b) Leukoplakia or smoker's patches.[9] This condition manifests itself on the inner surface of lips and cheeks, in the dorsum and edges of the tongue by sharply outlined, dull white or silver white points, disks, streaks, bands, ribbons or patches of irregular shape, flattened or elevated, discrete or confluent. The masses are made up of hyperkeratinized epithelium with an extremely chronic evolution. (c) Chronic fissures occurring especially in the median line of the lower lip, usually worse in the winter. (d) Verruca vulgaris. (e) Scars resulting from removal of teeth. (f) Lacerations produced by permanent partial dentures. (g) Syphilitic gumma of the tongue especially. (h) Defects due to chronic irritation from tobacco.

2. The presence of gross oral sepsis as evidenced by one or more of the following findings: (a) Hyperemic, bleeding, spongy gums, from most of which pus could be expressed easily. (b) Discolored, tartar-covered, uneven, ragged-edged, jaggy, worn-down, sharp or broken teeth, showing absorption about the alveolar processes and the presence of pus pockets. (c) Lacerations about the mucous membrane of gums, cheeks and tongue. (d) *Fetor ex ore.*

Fig. 7.—Carcinoma of the lip, of progressive character, with nodular border, neoplastic nodule formation and oral sepsis.

3. The occurrence of carcinoma past the age of 35 in the large majority of patients, which calls for the scrupulous examination of patients past this age as they appear for their usual dental care.

These three points will be apparent, and their practical importance will be

9. Footnote 8, p. 1210.

emphasized if the accompanying illustrations are carefully studied.

CLASSIFICATION AND PHYSICAL SIGNS

Carcinoma of the oral cavity takes on various appearances dependent on its location, cellular composition, relative malignancy and the age of the patient.

In general[10] and considering the types purely from a clinical standpoint, one may classify them into three groups: (1) superficial papillary; (2) deeply infiltrating; (3) central.

Time will not permit the description of each of these individually, but the photographs that are appended will visualize the protean character of the disease.

Fig. 8.—Teeth ground down and uneven, with oral sepsis.

The clinical pictures emphasize: (1) production of tumor; (2) its hardness and firmness; (3) inseparability from the surrounding structures; (4) lack of a separating capsule; (5) presence of degenerative changes in the form of ulceration; (6) encrustation; (7) ready bleeding of the ulcer base; (8) presence of a nodular, hard border, which is uneven; (9) failure on the part of Nature to show any repair; (10) neoplastic nodule formation; (11) presence of an unusually offensive discharge, especially in the intra-oral type; (12) in the advanced type, the presence of glandular enlargement in the nearby lymphatic glands.

Malignancy of the various carcinomas of the oral cavity cannot be judged by the size of the new growth. Clinically, one can judge it only by the rapidity of the metastases which manifest themselves in the lymphatic glands, so that a large fungating type of carcinoma may be relatively much less malignant than a much smaller ulceration.

Although the greatest number of patients presenting carcinoma of the oral cavity are men, this disease occurs also in women.

Fig. 9.—Carcinoma of floor of the mouth, with oral sepsis.

DIFFERENTIAL DIAGNOSIS

In the differential diagnosis, one must consider a fair number of diseases, namely: (1) syphilis in its primary and tertiary stages; (2) tuberculosis, nodular, ulcerative type; (3) simple ulcers; (4) fissures; (5) warty growths; (6) new growths other than carcinoma: (a) myxoma, (b) sarcoma, (c) teratoma, (d) adamantinoma, (e) fibroma, (f) osteoma, (g) myoma, etc.; (7) granuloma, as in actinomycosis and blastomycosis.

10. Mead, S. V.: Diseases of the Mouth. St. Louis: C. V. Mosby Co., 1927, p. 428.

Most important in this group is the differentiation of carcinoma from syphilis. At this juncture, one is compelled to repeat the oft-stated observation that syphilis and carcinoma are frequently coexistent in the same patient. Especially is this true of carcinoma of the tongue. The coexistence of these two diseases is a most serious complication to the patient because it usually leads rapidly to a fatal termination. In the presence of carcinoma, the treatment of syphilis must become secondary. Experience has shown that the ordinary arsenical infusions (arsphenamin, neo-arsphenamin, etc.) cause a rapid proliferation of the tumor cells and early death of the patient.

Fig. 10.—Intra-oral carcinoma, with oral sepsis and glandular metastasis.

The age of the patient enters into consideration; ordinarily, the younger the patient, the more rapid the development of a carcinoma, once it becomes established. Especially is that true of patients who are under 35 years.

SURVEY OF THE MOUTH

The most important clinical factor is the general appearance of the mouth *in toto,* and it is the chief object of my appearance before you. The accompanying illustrations show eleven cases all presenting gross evidence of carcinoma, and all showing the character of oral sepsis referred to previously. This is the important fact that I wish to visualize to you: The oral sepsis is of a major character. Bleeding, pus exuding gingival margins, discolored, loose, uneven, projecting teeth, badly approximated permanent bridgework, all help to produce an unsanitary, unhygienic, unsightly flora, with a marked fetor of the decaying food mixed with living and dead bacteria.

In taking a survey of a mouth, one must be mindful that a complete clinical picture can be obtained only in the following manner:

1. A careful inspection of the mouth, with notations as to the findings (with good light and good exposure of the intra-oral cavity) is necessary.

Fig. 11.—Carcinoma of lip, with oral sepsis.

2. Gentle pressure is exerted on the gingival margin to ascertain the presence or absence of purulent material.

3. The looseness or firmness of teeth is determined.

4. A smear is taken from the gingival pockets to stain for the fusiform bacillus and spirochete of Vincent.

5. The vitality test is made with the so-called pulp tester.

6. Transillumination is carried out to determine the presence or absence of shadows in the soft tissues of the gums.

7. Roentgen-ray examination is made of the entire upper and lower jaw.

When all these procedures are summarized, one gets a fair idea of the condition of the mouth.

The question of irritation from tobacco in those patients who chew and in those patients who use it in the form of cigars and in pipes is always a pertinent one.

I have an example of a patient who chewed tobacco for forty years. At the site where he kept his wad of tobacco, an

Fig. 12.—Patient shown in Figure 11. An extensive operation was performed with no attempt to correct the septic condition of the mouth.

ulcerative infiltrating carcinoma occurred. Oral hygiene, of course, was at its worst.

The pipe smoker who always holds the stem over the same spot on the lower lip seems to be frequently affected. The so-called dry smoker, the fellow who hangs on the end of an unlit cigar, is also a member of this group.

In order to get away from the irritation of tobacco and from the irritation produced by dry heat, one of the first orders forbids the use of tobacco in any shape or form in the presence of carcinoma of the oral cavity.

Location of the carcinomatous process is of great importance from the standpoint of malignancy. I believe that carcinoma occurring at the floor of the mouth presents an almost hopeless form of it, possibly owing to the fact that metastasis occurs relatively early, and the disease spreads without cellular impediment.

TREATMENT OF CARCINOMA OF THE ORAL CAVITY

Carcinoma of the oral cavity, when once it becomes an established entity, presents a definite surgical condition, the treatment of which demands no half-hearted measures. The surgical principles involved are the same as they are for any other type of operative work; namely, the eradication of the disease process under the most sterile conditions obtainable. It is the consideration of the latter which needs explanation. The clinical pictures which I have submitted to you emphasize the presence of sepsis of the mouth. Surgical procedures in the presence of infection are to be avoided as much as possible. Therefore, as a result of observing a fair number of patients and leaning on the experience of others, this axiom is promulgated: Before radical treatment of the carcinoma is undertaken, the mouth should be put in the best possible hygienic condition.

The element of time is of immense importance in this preoperative treatment. A rapidly progressing disease such as carcinoma demands immediate attention. Therefore, there is but one procedure which seems to me the logical one and that is the extraction of all the teeth to permit the field of operation to become as sterile as possible. To take

this step, it is necessary to keep in mind that (1) this procedure is not carried out with the usual conception of focal infection, the adjacent effect of chronically recurring and constantly repeated microbic irritation being the dominant thought; (2) any other measure which might be attempted to improve the flora of the oral cavity would be entirely too slow for consideration in oral carcinoma.

In carrying out this process of complete edentation, one accomplishes two purposes with one measure: 1. The patient's mouth becomes amenable to good surgery. 2. A chronically recurrent irritation is eliminated, and thereby the chances of recurrence of carcinoma are reduced.

After the mucous membrane of the mouth begins to show healing following the extraction, and this usually takes from seven to fourteen days, the lesion itself is attacked. My preference as to choice of methods is in the following order:

1. Implantation around and within the tumor mass of gold filtered radium emanation seeds, 1 millicurie each, to 1 c.c. of the mass.

2. Wide resection of the mass with the so-called "radio knife."

Either of these procedures is then followed by the exposure of the cervical lymphatic glands, should these be palpable.[11] This procedure can be done easily, as a general rule, under local anesthesia, though general anesthesia can be used; and the palpable and visible lymphatic glands are implanted with radium emanation in gold filtered seeds or needles in the same manner as the mass itself.

Deep roentgen-ray irradiation of the entire gland-bearing area on both sides of the neck is given.

CONCLUSIONS

In the presence of carcinoma of the oral cavity, the first and most important step is the removal of all the teeth in order to produce a relatively sterile field for whatever surgery may ensue.

The rôle of the dental surgeon is most important in prophylaxis and periodical mouth examination with carcinoma in mind.

631 Jenkins Building.

11. Quick, Donald: Carcinoma of the Lower Jaw, Am. J. Surg., 1: 360-364 (Dec.) 1926.

A REVIEW OF FORTY CASES OF RETAINED FRACTURED ROOTS OF ANTERIOR TEETH*

By LOUIE T. AUSTIN, D.D.S., Rochester, Minn.

OCCASIONALLY, a tooth with a fractured root may react positively to a vitality test. In the Mayo Clinic recently, I found forty records of fractured single-rooted anterior teeth, a number of which had reacted positively to the pulp test. Only eighteen of the forty patients (thirty-one men and nine women) were able to give a history of the accident causing the fracture. The ages of the patients at the time of examination ranged from 12 to 63 years. The

*From the Section on Dental Surgery, the Mayo Clinic, Rochester, Minn.

longest period that a fractured tooth had been retained was fifty-two years.

There was a positive response to the vitality test in thirty-one cases and a negative response in nine. The color of all teeth that responded positively was normal. Some changes had taken place in the pulp canal in six teeth, and the remaining thirty-four were normal as compared with the neighboring teeth.

There were four fractures in the apical third of the teeth, thirty-six fractures in the middle third and none in the cervical third. Two of the teeth fractured in the apical third were negative to the pulp test.

There was noticeable displacement of the end of the fractured root in twenty-seven cases. Eleven teeth were displaced laterally and sixteen longitudinally. Four of those displaced laterally were negative to the pulp test (Fig. 2, *a*). Six of those displaced longitudinally were negative to the pulp test.

The line of fracture was transverse in thirty-eight teeth and diagonal in two. One of the latter gave a positive response to the pulp test.

There was malposition of the coronal portion of the teeth in three cases. One of the teeth gave a negative reaction.

Periapically, the bony tissues appeared normal in thirty-six cases. There was some rarefaction in four cases. One of these was negative to the vitality test and had only a slight area of rarefaction. The bone tissue surrounding the walls of the teeth was normal in thirty-two cases. In eight cases, there was some rarefaction at the line of fracture (Fig. 2, *b* and *c*). In three of the eight cases, there was a definite area of rarefaction and all the teeth were negative to the vitality test. In two cases, there were slight areas, and the teeth were negative to the vitality test.

Fractured left cuspids or lateral incisors were not found in the roentgenograms observed. Twenty left central incisors, seventeen right central incisors, two right lateral incisors and one right cuspid were observed. Of the cases in which the left central incisor was fractured, the lateral incisors were present in all but two, and the right central incisors were present in all cases. Of the seventeen cases in which the right central incisor was fractured, the lateral incisor was absent in one case and the left central incisor in one case.

The calcification was complete in all the anterior teeth at the time of fracture,

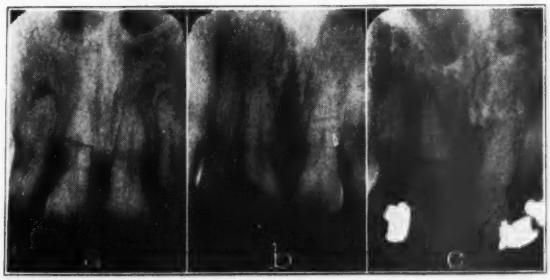

Fig. 1.—Vital teeth; the usual appearance of those teeth that are normal in color and negative to the vitality test. The fracture is in the middle third of the root. The tooth is comfortable and in good occlusion.

as the shortest history from the time of fracture was ten years.

In some cases, there was an apparent effort on the part of Nature to repair the fractured root (Fig. 3).

Howe[1] reports a fractured tooth with repair.

None of the teeth created discomfort except in one case in which the patient explained that her tooth was still sensitive to percussion. The tooth referred to had been fractured one year previously.

The fact that a large number of the patients were not aware that their teeth were fractured, together with the fact that the condition can be easily overlooked in the dental roentgenogram, leads one to believe that the condition is more common than is supposed.

Fig. 2.—Fractured teeth which were negative to vitality test. Areas of radiolucency are present.

Fig. 3.—Fractured teeth which were normal as to vitality test, of normal color, occlusion, etc. Nature has attempted to repair the fracture.

Accidental fracture of the anterior teeth should not necessarily condemn these teeth to immediate extraction unless there is considerable displacement, and especially if the middle third of the root is fractured.

1. Howe, P. R.: New Research on Dental Caries, Dent. Cosmos, 68: 1021-1033 (Nov.) 1926.

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C. N. JOHNSON, Editor

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Editorials

SHALL WE ABANDON OUR BIRTHRIGHT?

Certain individuals or groups in our profession have from time to time advanced the idea that we should no longer exist as a separate calling but that we should sink our identity and become a specialty of medicine. Just now in some quarters there seems to be almost a fanatical effort to bring this about and every means holy or unholy is being employed to foster this idea. Let us see.

We may acknowledge that it is no longer pertinent to allude to the fact that at one time dentistry begged to be taken under the wing of medicine and was curtly refused; but it is pertinent to ask the question, in the light of subsequent developments, whether the people of this country would have been better cared for if dental service had been administered under the direction of medicine, and as one of its specialties, than it has under the plan that was forced on us in the early days by the refusal of medicine to accept us. No man in the wildest stretch of his imagination can argue that the science and art of dentistry has not advanced to an infinitely

greater perfection under the present plan than it possibly could as an appendage to another calling. If concrete proof of this is asked, it is only necessary to cite the quality of dental service rendered to the people of those countries where dental education and licensure are under the domination of medical boards and compare it with the service rendered where dentistry dominates its own policies. We are the farthest in the world from wishing to make invidious comparisons, but all we ask is that a comparison be made.

Neither has there ever been recorded a conspicuous success where the attempt has been made to educate dental students in an institution controlled or directed by a medical faculty. In other words, dentistry has never been well taught in a medical college having a dental department. In the very nature of things, it could not be expected that such a plan would be successful.

It is fruitless to argue that there is need for greater breadth of vision in dentistry, for the very simple reason that everyone acknowledges this need. Neither can the principle be questioned that there should be a closer cooperation between medicine and dentistry—no one questions it. But there is a question, a legitimate one. Would dentists gain a broader vision if they practiced as a specialty of another calling than if they followed a pursuit which has already become well established as a recognized profession in itself?

Dentistry has not built its birthright for nothing. It has after long years of individual and collective effort, and sometimes of intense struggle, attained a status in the public estimate that constitutes it as one of the great health agencies of the age. Several great dental philanthropies have been inaugurated as a direct result of the impression made on our philanthropists by the service that dentistry has rendered, and the insistent need that this service be carried to the relief of the poor. Had it not been for this, it is inconceivable that such benefactions would have ever eventuated as those of the Forsyths, Mr. Eastman, Mr. Rosenwald, Mrs. Carter of Honolulu and now the Guggenheim Foundation.

We have, in this country alone, about forty institutions dedicated to the teaching of the science and art of dentistry, and there are societies almost without number where our members meet to deliberate on the most approved methods of serving the people. The American Dental Association has a membership of approximately 35,000, and its official publication goes monthly to more than 36,000 readers. In addition to this, there are many other dental journals which add their quota to the distribution of dental knowledge, and there is a textbook literature which is a distinct honor to any profession.

Shall all of this be swept away by the wave of a few fanatical hands? Shall all the splendid traditions of our profession be buried beneath the wreck of the iconoclast? We shall gain little in respect and we shall lose much, even in the minds of the better element of the medical profession, by the attempt at this late date to attach ourselves to the band wagon of medicine and trail along behind like the little dog that has been clipped for the occasion.

Our birthright means too much to us to go begging to any profession for affiliation. When we are measured in the alembic of concrete service to humanity, we need not hang our heads nor duck under anybody's wing. We invite the most cordial and close cooperation with our medical friends. We honor them for their signal service in the world, and we glory in their every achievement; but we have directed our own destinies too long to yield up our professional birthright for a mess of anybody's pottage.

If we had been a failure and our policies a mistake, there might have been some logic in begging another profession to mother us, but the farther we go in our individual development and the more perfect we become in our organized efforts—not only in our administrative affairs but in our scientific growth—the less effective the argument becomes that we shall yield our sovereignty of soul and enlist under the banner of another profession.

Mayhap in the fullness of time when dentistry shall have brought to fruition some of the problems which she has set herself to solve, these protagonists of this so-called reform may become

convinced of their folly and fall into line for the common good. As it is now they are little better than a nuisance and their efforts are redounding to the benefit of no one. Up to this time they have not suggested a single constructive idea, and everything they have done has tended to tear down instead of build up.

Dentistry has developed specialties in its own field that are outstanding in their service, and it is absurd to try at this advanced stage of its growth to submerge its entire fabric in the body politic of another calling. It cannot be done.

THE NATIONAL INSTITUTE OF HEALTH

Never before in the history of this country has there been a more constructive piece of legislation than the passage of the Ransdell bill by Congress for the establishment of a National Institute of Health at Washington, which was signed by President Hoover, May 26, 1930. Up to this time, it has been notorious that the Government has always taken more interest in preserving the health of domestic animals than in protecting its own citizens. For instance, the Federal Government in the five years prior to 1929 spent something like $54,000,000 in the interest of animals and plants, and this was really a laudable and proper allotment of the public funds. No one will question the propriety of such an expenditure, but the significant thing in this connection is that during the same period only about $4,000,000 was spent by the Federal Government for scientific research in diseases that affect the human family. Had it not been for private philanthropy, the sums devoted to the study of human ailments would have been wholly inadequate to keep pace with the increasing susceptibility to disease due to modern environments, and to the never ceasing attack of new diseases or the new manifestations of old diseases.

The passage of this bill has a significance wholly aside from the concrete benefit that will accrue from its provisions. Great as this benefit undoubtedly is, it is as nothing compared with the fact that it is the first really tangible and avowed recognition on the

part of Congress that it has a definite obligation to lend its aid in the control or prevention of human disease, and to concern itself in any way with the maintenance of human health. It has been rather humiliating in the past to realize that our Government was more concerned in the welfare of animals, domestic and wild, than in that of men, women and children. Its concern for animals has been legitimate and altogether praiseworthy, but its neglect of the health of its people has not measured up to the most exalted function of a government. Not only that, but its policy in this regard has been wasteful in the extreme. It is estimated that the economic loss in the sacrifice of human lives in this country due to ignorance or neglect amounts to nearly $6,000,000,000 and that the cost of preventable disease during a single year runs up to over $2,000,000,000.

Not that all of this appalling loss will be wiped out by the passage of the Ransdell bill and a mere wave of the hand, but it is at least a gesture on the part of Government that it recognizes the fact that the preservation of human health involves a problem and it is willing to do its share in solving this problem. And we are justified in being very hopeful as to the outcome. When we consider what has already been accomplished by the workers in the Hygienic Laboratory with the assistance of the most meager funds, we can well visualize the possible achievements of our scientific men when backed by adequate financial support.

The greatest asset that any nation can claim is the quality of its people, and this quality is represented not only by its mental stature but by its physical equipment; because, after all, physical fitness and mental acumen go intimately hand in hand. Give us a nation of rugged healthy citizens and we shall show an achievement in the years to come than which there has never before been anything to compare with it. In all human history, there has been no advance equal to that which may be made by this nation under the stimulus given the people by the enactment of this legislation. We should line up every agency tending toward the support of the Government in this laudable enterprise because now we have the assurance that at last the Government is determined to do its share.

The thanks of all good citizens are due to Sen. Joseph E. Ransdell, of Louisiana, for introducing and sponsoring this bill and working unceasingly for its passage. It required nearly four years of constant effort from the time of its first introduction in July, 1926, till its final passage in May, 1930, so slowly do some constructive measures move in Congress; but the result is well worth the effort, and Senator Ransdell may appropriately be congratulated on his outstanding service. It so befalls that very worthy men may sometimes serve in our legislative halls for many years without having the satisfaction of pointing to any single act of major accomplishment on their part, but this fate has not been reserved for Senator Ransdell. In the days to come when the full beneficence of his service is made manifest through a greater relief of human suffering, and an increased efficiency of our citizens, he may bask in the comforting reflection that it was his vision and his initiative that was mostly instrumental in bringing to fruition the consummation of this humanitarian achievement.

THE SUBLIMITY OF SERVICE

The incentives behind every activity of life will vary according to the individual and his point of view. Every man seeks happiness in his own peculiar way, and the fact must be apparent that often he does not seek it in the most effective way. A relatively large number seek it through the medium of money, but money alone never brought happiness. Others seek it through the medium of gaining power, but power never brought happiness to any one unless the greatest wisdom was exercised in using it; and few men have acquired sufficient wisdom to use power properly. But there is one thing that everybody can do, and through which happiness may be achieved if it is possible to achieve it at all. This is through the subtle influence of service. To dispense service to others in an unselfish way is to state the heights and depths of satisfaction, and to achieve the most sublime mission of life. This then is the true philosophy of the best kind of living.

EDWARD HARTLEY ANGLE, D.D.S., M.D., Sc.D.

(1855-1930)

Dr. Angle was born at Herrick, Pa., June 1, 1855, and died at Santa Monica Beach, Calif., Aug. 11, 1930. His early education was received in the high school of Canton, Pa., and in 1878 he was graduated from the Pennsylvania College of Dental Surgery. He early showed an aptitude for mechanics, an accomplishment that remained with him to the end of his days. After graduation, he began practice in Towanda, Pa., but being threatened with tuberculosis, he went west and lived on a ranch for two years. He then established himself in Minneapolis, Minn., in the practice of dentistry and began specializing in orthodontia. About 1892, he moved to St. Louis, Mo., where he organized the Angle School of Orthodontia, in 1900. In 1908, he retired from practice and moved to Larchmount, N. Y., and from there to New London, Conn. About 1913, he moved to Pasadena, Calif., where he lived till his death. After his retirement, he devoted all of his time to teaching, writing and improving his system of orthodontia.

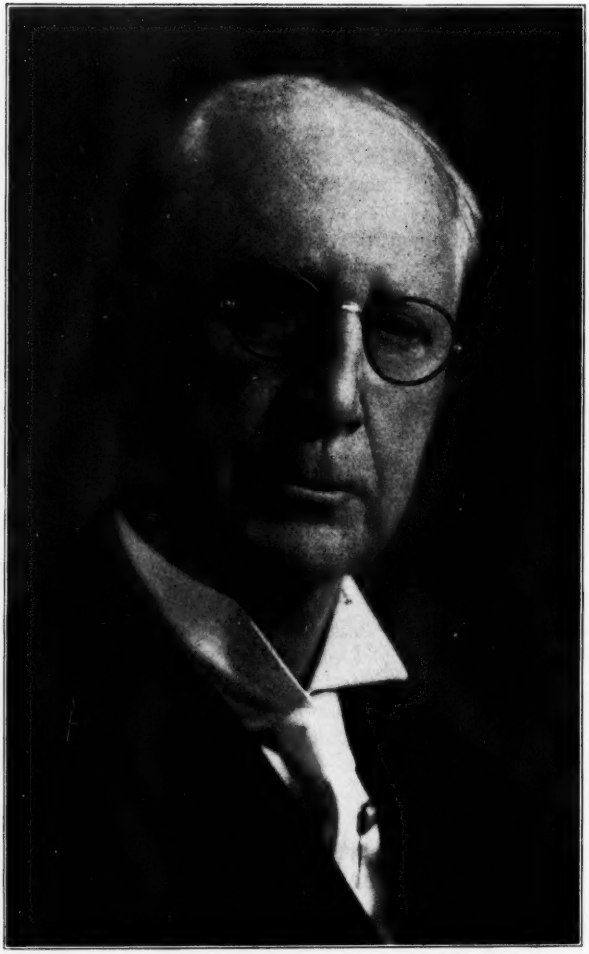
Dr. Angle held the chair of orthodontia in the University of Minnesota 1887-1892; in Northwestern University Dental School, 1892-1898; in Marion Sims College of Medicine, 1896-1899; and in the Dental Department of Washington University, St. Louis, 1897-1899.

In 1897, he received the degree of M.D. from Marion Sims College of Medicine, and in 1915, the degree of Sc.D. from the University of Pennsylvania. At various times, he was also the recipient of many diplomas and honorary memberships from societies in this country and abroad.

Dr. Angle made a distinct impression on the profession from the moment he began specializing in orthodontia. Strong in his likes and dislikes, with him there was no middle course and no compromise. He worshiped perfection and chafed when the ideal could not be reached. No amount of application was ever too great when he set himself to the task of solving a problem, whether in the evolution of a principle in practice or the perfection of a piece of mechanism. His name will be linked with the science of orthodontia as long as its history is written.

To escape the intense and unusual heat in Pasadena this summer, Dr. and Mrs. Angle had moved to Santa Monica Beach, where he continued his work almost to the hour of his death. It was typical of him that he should die in harness.

Dentistry has need of men of strong personality and intensity of purpose, and it matters less whether or not an individual may always be 100 per cent right in every one of his conclusions than it does that he compels the profession to think and to study through the force of his profound convictions and his dynamic energy. Dr. Angle's service to the profession he loved so well must be recorded as a distinct asset to dentistry and his passing will be regretted by a wide circle of friends and admirers the world over.



EDWARD HARTLEY ANGLE, D.D.S., M.D., Sc.D.
(1855-1930)

COUNCIL ON DENTAL THERAPEUTICS

COD LIVER OIL

OWING to its favorable influence on the absorption and subsequent deposition of calcium and phosphate in the bones, cod liver oil is considered to be among the medicinal foods which, because of their vitamin content, apparently have a beneficial effect on the development of teeth and aid in the prophylaxis against caries. The exact rôle that vitamin D plays in such prophylaxis is at present not clearly understood. The substance called vitamin D, which is active in calcification, is associated with the unsaponifiable fraction of the oil and may be identical with the product formed by the irradiation of ergosterol.

Means for determining the vitamin D content have not been sufficiently developed to warrant the adoption of a specified procedure for standardization. However, manufacturers whose products are listed in A. N. D. R. have adopted such methods as will enable them to indicate that their products are effective in the cure of experimental rickets and are therefore suitable for administration and to be preferred to those brands whose potencies are not stated.

The beneficial properties of cod liver oil are due not alone to vitamin D. Cod liver oil also contains vitamin A (anti-ophthalmic), which possesses definite growth-promoting and anti-ophthalmic properties. In the presence of adequate quantities of vitamin D, the potency of the oil as regards vitamin A has only an indirect bearing on the question of calcification.

The standards adopted for New and Nonofficial Remedies, 1930, require that each gram of oil contain at least 400 units of vitamin A when tested by the U. S. P. X method. The same standard is adopted for A. N. D. R.

Detailed accounts of the vitamins can now be found in the newest textbooks on physiologic chemistry and nutrition.

ACCEPTED NONOFFICIAL DENTAL REMEDIES

The following articles have been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association for inclusion in the list Accepted Nonofficial Dental Remedies. A copy of the rules on which the Council bases its action will be sent on request.

SAMUEL M. GORDON, *Secretary.*

COD LIVER OIL.—Oleum Morrhuae.—For description see the U. S. Pharmacopeia and Useful Drugs.

Cod-Liver Oil-Squibb.—It has a content of fat soluble vitamin A which is not less than 500 units per gram, and its antirachitic potency is demonstrated by determining its power of producing a line of recalcification in the leg bones of rachitic rats.

Dosage.—The average adult daily dose is 15 c.c. (4 fluidrachms); for children, half this amount or less; for infants, from 0.5 to 2.0 c.c. (8 to 30 minims) according to age.

Manufactured by E. R. Squibb & Sons, New York. No U. S. patent or trademark.

Squibb's Mint-Flavored Cod-Liver Oil: Cod-liver oil-Squibb, containing 0.67 per cent of oil of spearmint as flavoring.

Cod-liver oil-Squibb complies with the U. S. P. standard for cod-liver oil. In addition, it is required to have a content of fat soluble (anti-ophthalmic) vitamin A, determined by the method of the U. S. P., of not less than 500 units per gram. Its antirachitic (vitamin D) potency is tested by determining the minimum quantity that will give in ten days a continuous line of recalcification, through the rachitic metaphyses of the leg bones of rats fed Steenbock's rickets-producing diet 2965 (*J. Biol. Chem.*, 64:263, 1925). Litter mate controls must show completely recalcified metaphyses of the leg bones.

Mead's Standardized Cod Liver Oil.—It has an antirachitic potency such that one-fourth of 1 per cent cures experimental rickets in rats in five days when added to the diet. It is also required to have a vitamin potency such that 0.002 gm. will cure ophthalmia in rats.

Manufactured by Mead Johnson and Co., Evansville, Ind. No U. S. patent or trademark.

Mead's Standardized Cod Liver Oil, Flavored: Mead's standardized cod liver oil, containing 0.12 per cent of a mixture of vanillin and oil of lavender as flavoring. Mead's cod liver oil complies with the U. S. P. standards for cod liver oil. In addition, it is required to have an antirachitic potency such that one-fourth of 1 per cent, when added to the diet of rats suffering from experimental rickets, will cause complete healing of the lesion in five days as determined by the method of McCollum, Simmonds, Shipley and Park (*Proc. Soc. Exper. Biol. and Med.*, 19:123, 1921). It is also required to have a vitamin potency such that 0.002 gm. will cure ophthalmia in rats as determined by the method of Zilva and Miura (*Biochem. J.*, 15:654, 1921).

Nason's Palatable Cod Liver Oil.—Cod liver oil containing not less than 0.5 per cent of essential oils as flavoring, having a vitamin A potency as determined by the U. S. P. X test of not less than 1,000 vitamin A units per gram and a vitamin D potency of not less than 150 units per gram.

Dosage.—For adults, 2 to 4 c.c. (30 to 60 minims), three times a day; for children, 1 to 2 c.c. (15 to 30 minims), three times a day.

Manufactured by Tailby-Nason Co., Boston. No U. S. patent or trademark.

Nason's palatable cod liver oil complies with the U. S. P. standards for cod liver oil. In addition, it is required to have a content of fat soluble vitamin A, determined by the U. S. P. method, of not less than 1,000 units per gram, and an antirachitic potency such that 0.0066 gm. per day will produce definite healing (as determined by roentgen-ray photographs) in the leg bones of rachitic rats in eight days when added to a diet lacking in vitamin D, the rats being also deprived of ultraviolet light.

Parke, Davis & Company's Standardized Cod Liver Oil.—It has a content of fat soluble vitamin A which is not less than 500 units per gram, and a vitamin D potency of not less than 112 units per gram.

Dosage.—Infants, from 1 to 2 c.c. (15 to 30 minims); older children, from 2 to 4 c.c. (30 to 60 minims); adults, 4 c.c. (1 fluidrachm) or more, three times a day.

Manufactured by Parke, Davis & Co., Detroit. No U. S. patent or trademark.

Parke, Davis & Company's standardized cod liver oil complies with the standards of the U. S. Pharmacopeia. In addition, it is required to have a content of fat soluble vitamin A, determined by the method of the U. S. P., equivalent to 500 units per gram (one unit being the amount required to correct both the induced xerophthalmia and retarded growth of young albino rats) and an antirachitic potency when determined by the method of McCollum, Simmonds, Shipley and Park (*J. Biol. Chem.*, 51:41, 1922) of not less than 112 units per gram (one unit being the amount of cod liver oil required daily to initiate recalcification in the leg bones of young albino rats.)

Patch's Flavored Cod Liver Oil.—Cod liver oil containing less than 0.5 per cent of essential oils as flavoring and having a vitamin A potency of not less than 1,000 vitamin A units to the gram as defined in the U. S. P. X, and a vitamin D potency of not less than 125 units per gram.

Dosage.—4 c.c. (1 fluidrachm), 3 times a day; children 2 c.c. (30 minims) 3 times a day.

Manufactured by the E. L. Patch Co., Boston. No U. S. patent or trademark.

Patch's flavored cod liver oil complies with the U. S. P. standards for cod liver oil. In addition, it is required to have a content of fat-soluble vitamin A of not less than 1,000 units per gram (one unit being the least amount required daily to promote a renewal of growth in albino rats that have ceased to grow and may show symptoms of malnutrition such as xerophthalmia, on diets adequate except for vitamin A) and an antirachitic potency, determined by a modification of the method of McCollum, Shipley, and Park, of not less than 125 units per gram (one unit being the least amount of cod liver oil required daily for eight days to promote recalcification in the tibias of young albino rats suffering from experimental rickets).

DENTIFRICES

The Council has adopted the following chapter on dentifrices for "Accepted Nonofficial Dental Remedies."

SAMUEL M. GORDON, *Secretary.*

Dentifrices are defined as preparations (pastes, powders and liquids) which aid in the removal of débris from tooth surfaces.

Tooth pastes and powders on the market today may in general be placed in several groups or combination of groups; namely, those depending primarily on soap for their cleansing action; those containing small amounts of organic acids; those containing magnesia magma or other alkaline substances and those containing other substance or substances, such as potassium chlorate, calcium phosphate, organic or inorganic astringents, antiseptic or germicidal substances, enzymes, etc. These substances are generally admixed with chalk for abrasive action and incorporated in paste form by glycerol (or glycerite of starch), tragacanth, acacia or other pharmaceutic binders.

Many dentifrices on the market today are unnecessarily and irrationally complex in composition. The Council desires to point out that the aims of rational therapeutics and "oral hygiene" are defeated by the use of complex mixtures, not to mention the large economic waste in the sale of highly complex mixtures when simpler combinations are just as effective. This is in keeping with the well known observation that dentifrices have no direct demonstrable therapeutic action. The sole function of a dentifrice is to aid in keeping the teeth clean by the removal of loose food débris by the mechanical use of the toothbrush.

The Council appreciates that long established customs cannot be changed at once; hence, it will, for the time being, adopt a very liberal policy in regard to the composition of dentifrices. Its labors for the near future will be directed toward a control of irresponsible claims made in dentifrice advertising; but it will apply with the greatest leniency compatible with consistency, a very liberal policy regarding the composition of this class of products.

In addition to the rules of the Council (THE JOURNAL, April, 1930), the Council has formulated certain provisions for the inclusion of dentifrices in "Accepted Nonofficial Dental Remedies." The provisions follow:

Dentifrices (with especial reference to those advertised to the public) may be accepted for inclusion in the list of "Accepted Nonofficial Dental Remedies" provided:

Claims are strictly limited to their efficacy as an aid in the hygiene of the oral cavity and particularly to their mechanical cleansing properties.

No unwarranted therapeutic, chemical or bacteriologic claims are made or inferred in their exploitation.

Therapeutically suggestive names are not used as a brand name.

The brand name is not indicative of a component which does not possess proven therapeutic properties or other inferred properties implied in the name.

There is no conflict with the rules of the Council.

The provisions in reference to proprietary names will not be retroactive.

The Council has further provided that dentifrices will be accepted for a period of one year in contrast to the usual three year acceptance clause for other classes of products to be listed in "Accepted Nonofficial Dental Remedies." At the end of this period, the evidence for reacceptance will be examined by the Council. If no conflicts with the rules or provisions of the Council appear, the product will be retained for a further period of one year.

In order that the Council may be informed of the advertising regarding a dentifrice during the period of listing in A. N. D. R., manufacturers or their agents will be requested to submit copies of all advertising in professional journals and magazines or newspapers published primarily for the laity.

From time to time, the claims for various dentifrices will be discussed.

ACCEPTED NONOFFICIAL DENTAL REMEDIES

The following article has been accepted as conforming to the rules and provisions for dentifrices of the Council on Dental Therapeutics for admission to "Accepted Nonofficial Dental Remedies." A copy of the rules on which the Council bases its action will be sent on application.

SAMUEL M. GORDON, *Secretary*.

COLGATE'S RIBBON DENTAL CREAM. — *Composition:* Each 100 gm. contains glycerin, 28.0 gm., soap (vegetable), 5.0 gm., calcium carbonate, 35.7 gm., precipitated chalk, 7.6 gm., sodium benzoate, 2.1 gm., aromatics, 0.9 gm., corn starch, 6.5 gm., water, 14.2 gm.

Claims: No claims, except that it is an effective cleansing agent, are made.

Manufacturers: Colgate-Palmolive-Peet Co., Chicago, Ill.

BUREAU OF CHEMISTRY

EMEDENT PYORRHEA TREATMENT

DR. C. S. WILLIAMS

FOR some time, the A. D. A. Bureau of Chemistry has been receiving inquiries from dentists in the south regarding Emedent Pyorrhea Treatment put out by Dr. C. S. Williams, of Ellisville, Miss., who operates under the trade style Emedent Pharmacal Company. One dentist writes:

I have a preparation which I would like to bring to your attention. It is called Emedent and is made by Dr. C. S. Williams of Ellisville, Miss. It is a so-called pyorrhea cure and I know that quite a number of men are using it.

Dr. Williams gave a clinic in this city at $100 per dentist and sells his preparation at $10.00 per bottle. Two of the men are using it and think it is wonderful. I procured some from one of these men for experimental purposes, but am afraid of it, not knowing what it is . . . In packing a full mouth, the reaction on the general system is terrific. Headache, pains in all parts of the body, loss of sleep, etc.

After a somewhat protracted correspondence, Dr. Williams furnished the Bureau with a "statement of composition" on Emedent Pyorrhea Treatment. The statement of composition which was furnished by Dr. Williams was not received until after the A. D. A. Bureau of Chemistry had completed its investigation of the product and had prepared a report on it. In view of Dr. Williams' statement which follows, it is apparent that the essential findings of the Bureau are in no way altered. Dr. Williams writes in part:

I am enclosing you the names of the preparations contained in or from which my Emedent Pyorrhea Treatment is made. The procedure of making it is a little lengthy and I am sure at this time you would not be interested in it.

Creosote B.W.
Oil Turpentine
Oil Cassia
Oil Eucalyptus
Acetic Acid
Sulphuric Acid
Iodine Tr.
Chloroform
Zinc Chloride
Chloral Hydratis
Potassium Chlorate
Flext. Calendula
Antiseptic Solution

I can state the proportion of each of these preparations started with, but am unable to tell the proportion in the finished product. I have a very competent State Chemist working on this and am also making some other tests, but at this time I do not know exactly the proportion of the finished product, however, I do know that it is harmless.

As already indicated, inquiries on the product were becoming so numerous that the Bureau deemed the examination of the product to be in the interests of the public and of the profession. The report of the A. D. A. Bureau of Chemistry follows:

A. D. A. CHEMIST'S REPORT

"One (1) original unopened package of Dr. C. S. Williams' Emedent Pyorrhea Treatment, price $10.00, was re-

ceived for examination from a dentist in Florida.

"Each package contained a circular of directions for the use of the preparation. Nowhere on the label or in the circular was a statement of composition found.

"The contents of the trade package measured 18.5 c.c. (approx. 3/5 fluid ounces) of a liquid, possessing an amethyst color and an acrid odor. The reaction to litmus was decidedly acid.

"The specific gravity at 20 C. was found to be 1.327.[1]

"Qualitative tests indicated the presence of free sulphuric acid. Organic matter was indicated. Heavy metals (such as mercury, aluminum, zinc, iron) were not found.

"Quantitative determinations yielded the following:

Ash	0.07 per cent
Chloroform soluble	0.05 per cent
Sulphuric acid (gravimetrically)	41.08 per cent
Sulphuric acid (by titration)	41.09 per cent

1. The U. S. Pharmacopeia X gives 1.3263 as specific gravity of 43 per cent sulphuric acid at 20 C. The difference between the figures and the analytical results is no doubt due to the presence of organic matter which slightly alters the specific gravity.

"From the foregoing, it may be concluded that Dr. C. S. Williams' Emedent Pyorrhea Remedy is essentially a 41[2] per cent solution of sulphuric acid in water."

A comparison of the report of the Chemist and Dr. Williams' statement is interesting. The chemical examination indicates that the product as it reaches the consumer is essentially a 41 per cent solution of sulphuric acid. Any effects are due to the necrotic action of this strong acid solution on the tissues.

The statements concerning the preparation of Emedent Pyorrhea Treatment reveal a lack of understanding of scientific pharmacy and rational therapeutics. The formula is reminiscent of the days of the old shotgun mixture, the use of which has long ago been discarded in rational therapeutics.

Ten dollars for less than 20 c.c. of a preparation containing essentially 41 per cent sulphuric acid is altogether disproportionate. Progressive dentists would hardly be impressed by the Dr. C. S. Williams Emedent Pyorrhea Treatment if the composition of the preparation were fully printed on the label.

2. In view of the indication of organic matter, it is probable that other ingredients are used in the preparation of Emedent Pyorrhea Treatment. The end results are as reported above.

BUREAU OF DENTAL HEALTH EDUCATION

THE GREAT NEED FOR DENTAL HEALTH EDUCATION*

By WILLIAM R. DAVIS,† A.B., D.D.S., Lansing, Mich.

WHEN I came to analyze the subject assigned me, "The Great Need for Dental Health Education," as a basis for a paper, I was immediately confronted with the fact that the *great need* for dental health education is the one thing on which there would be a unanimous opinion among all those in attendance at this Section. We have varying opinions on many phases of mouth hygiene as it relates to health and the means by which it can best be promoted, but on the *great need* for dental health education, we would be 100 per cent. Consequently, I am going to discuss what in my opinion are the *greatest* needs in dental health education. This will mean saying some things that I have said on other occasions, but I have no apology to make for this. Probably in all the vast number of papers and addresses at this meeting, little that is new will be said. It will be mostly reemphasis and reiteration. This, too, is fundamental in education, as every successful teacher, advertiser and propagandist has long since found out.

In considering the great needs in dental health education today, I am convinced that two are paramount: (1) the great need for better educational standards and (2) the great need for dental health education of the dentist.

In a consideration of better standards, what are some of the fundamental principles in education upon which our education should be based? We find that recognized leaders in education invariably lay down as the first fundamental principle the truth as nearly as it is known and the truth in proper balance without exaggeration or distortion.

An examination of a large number of samples of dental health educational material collected last year by the American Child Health Association with the help of the A.D.A. office for the purpose of judging its subject matter and educational value revealed statements in some of the best of it that surely are in contradiction of this principle. We expect to find bias and exaggeration in some advertising matter designed to sell tooth paste and mouth washes, but the quotations which follow were all taken from material put out by dental societies:

"Teeth should be brushed five times a day" seemed repeated continually. Is that true, or, in any case, is it not impracticable?

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

†Director, Bureau of Mouth Hygiene, Michigan Department of Health.

"Gauze on the finger and boric or salt solution should be used as a routine to wash the mouth of an infant" appears several times. Is that true? Pediatricians with whom I have talked and who are convinced of the importance of mouth hygiene tell me that it does more harm than good in a well child correctly fed.

Many teach the daily use of floss, which I consider will do more harm than good, especially in children, by destroying the interproximal gum tissue. Fortunately, children don't use it. It is hard enough to get them to use the brush. We doubt the wisdom of teaching brushing of the tongue, cheeks and roof of the mouth in healthy individuals. How many dentists do it and what is its value? Does this not rather lend support to the idea of faddism and help destroy the emphasis on recognized essentials?

One widely circulated and beautifully illustrated pamphlet makes the bold statement that "this (tooth decay) would never happen if every one brushed his teeth every day and cleaned the interproximal spaces." Does not nearly every teacher and pupil for whom this is intended know that it is untrue? Another widely read pamphlet says: "You might as well have a man pouring poison into the milk bottles in the morning as to have dirty teeth putting their poison into your food." Is that true? Would *you* just as soon have a man pour poison into your children's milk as to have them go without brushing their teeth? To ask is to answer.

The representative of the American Child Health Association who discussed this material said: "Exaggeration is the characteristic of quacks and faddists. Exaggeration and misrepresentation are surely none the less culpable because they are used by respected but careless members of the dental or medical professions in preparing authentic materials for use in schools. Exaggeration rouses the skepticism both of the critical educator and alert child."[1]

The foregoing quotations and statements are not made in any spirit of fault finding. They are made in an endeavor to cause more serious thought to be given to our educational material, in order that it may better fulfil its function and that it may commend itself to thoughtful teachers and public health workers. When a prominent physician devoting his life to child health and who believes absolutely in the importance of mouth health says: "So much of this material deserves unsparing criticism because it has no scientific confirmation," it behooves us to take note. He further says: "It seems to me there is so much that children must be taught that we know definitely about, that there is no necessity for exaggerated statements or claims that cannot be supported by scientific data. It is easy for teachers to teach untruths and these often react in a lack of confidence on the part of children when they learn the truth."

No. Faddism should have no place in education fostered by our dental societies. Let us stick to the truths that are being proved clinically and scientifically. Cleanliness is important, but why make claims for it that cannot be supported? Why give it the major place when it should come at least third? I think the truth is becoming overwhelming today that the two paramount factors in promoting mouth health are nutrition and early dental attention. Let us then put first things first. Howe, Bunting, McCollum and others I think are giving us some sane and scientific facts about diet. These

1. American Child Health Association Trans., Fifth Annual Meeting, p. 218.

certainly seem to prove the very great relation of nutrition to mouth health. Fortunately, this is being given considerable emphasis today, but here again we must avoid faddism and the false claims of commercialism. There is enough to teach that is on a sound foundation, and real research is adding to this foundation continually.

Early dental attention has not had anything like the attention it deserves. True, "visit your dentist every six months" and "start the child to the dentist at 2½ or 3 years," are heard commonly enough, but the reasons for this have not been made plain, and consequently the advice is not heeded as it should be. With all the propaganda of today, I frequently hear the most intelligent classes — teachers, school superintendents, nurses, health workers, even physicians—say: "I never heard of that before." And this, when I am actually demonstrating the presence and prevalence of developmental pits and fissures which frequently cannot be seen as the starting point of decay, tooth destruction and later infection; also the reasons that *early* dental attention is cheapest, easiest and best from every standpoint. The public has practically no knowledge yet of the vast difference between *restorative* dentistry and *preventive* dentistry. Let me quote from a very thoughtful article by Maurice Williams, which to my knowledge draws the best distinction between restorative dentistry and preventive dentistry: "Restorative dentistry is a luxury. It is dentistry for the few. For the vast majority of the American people, it is prohibitive. But perhaps the strongest indictment which can be brought against restorative dentistry is its irreparable neglect of the nation's children. A cardinal principle of dentistry is this: that of the several types of service which a dental office has to offer the health value of the service is inversely proportional to its cost."[2]

Here is dental health education which is absolutely sound; of supreme importance if we are to make real progress, and yet most neglected. We must tell the people what preventive dentistry is and what it can do for them in order to make them want it.

I submit, then, that proper nutrition and early dental attention are the two most important truths that are being demonstrated scientifically and clinically in promoting mouth health, and they should be given the most emphasis in our educational material. Of importance, too, is the relation of mouth infection to general health and the necessity for the elimination of infection when it has not been prevented. Follow this with the toothbrush as an aid but only an aid in promoting mouth health. Brushing twice a day is a sensible teaching.

Another fundamental principle which is so often violated in our educational material is brevity. Most of it is too long and the essentials are confused or are lost sight of by the reader. We want to tell the public too much, and much that is not essential. They do not need and do not want a course in dentistry. If the material is too long, it will not be read. If brief, simple, nontechnical, true and to the point, it will make a better impression and carry more conviction.

But while better educational material is one of the greatest needs in dental health education, I do not assume to place the other one mentioned second in importance. In fact, I am convinced that the greatest need of them all right now is the education of the dentist. For what is

2. Williams, Maurice: Dent. Digest, May, 1929.

the value of educating the public to want something that they cannot get? We are trying to educate the public in regard to the evil effects of mouth infection; and when they take their children with abscessed teeth to the dentist, he says: "Leave the teeth alone, they won't do any harm and they are needed to hold space or they'll come out after awhile." As a matter of fact, we see many deformities caused by parents heeding this advice of their dentists. Many dentists do not seem to know that the roots of deciduous teeth usually are not absorbed when the teeth are pulpless. But that is not the question. If infection is a menace to health, it should be eliminated. If it is not a menace to health, health departments have no right to employ dental health workers, and all this talk about the need for dental health education is nonsense.

Again, I mentioned above the great need to educate the public with reference to the value of preventive dentistry over reparative dentistry, but I wonder what really would happen if the public became educated and wanted preventive dentistry as much as it wants automobiles and radios and movies. You know when people really want things that much, they are going to try to get them some way. Suppose they should take us seriously and demand for themselves and families the service we are telling them that they need. How are they going to get it and what may happen to the dental profession in their efforts? I know that some of our members believe that education of the public is going to force the solution of this matter. It may, but not in the way the profession wants. This is no mere academic question. Every dental health worker with any experience knows that education of the public to desire dental health service is progressing more rapidly than the profession can supply the service. This is the most difficult problem that we face. Too often, our education is playing right into the hands of the quack, and people are getting septic dentistry instead of preventive dentistry. But the great trouble is that the vast number of the profession do not want to practice dentistry as a health service or else they do not know what dental health service is. They are willing to give lip service. The A.D.A. and a great many state and local societies have passed resolutions declaring "no defect is too slight to receive definite attention," "the temporary teeth should receive just as much care as the permanent ones," and more along this line. These resolutions have been passed without a dissenting vote. They have been printed in all our magazines, but to what purpose? An Irish friend in Boston recently told me the explanation. He said passing resolutions was the Scotchman's method of helping a worthy cause. I never realized before how many Scotchmen were practicing dentistry. Perhaps we can get the Irish after them and get some action. Let us hope so. At any rate, here is the most pressing problem in dental health education.

How are we going to educate the dentist? I wish that I knew. Education of the dentist is coming slowly. More dentists are giving real health service every year, but the number is pitiably small even yet. Of one thing I am sure: More attention must be given this phase of dentistry in our dental colleges, in order that the graduate may have a training that will fit him for, and give him a greater interest in preventive dentistry, and children's dentistry. Preventive dentistry and children's dentistry must have more attention in our small programs and study clubs. It means more or less close contact in small groups. Dentists are notoriously poor readers. They are very

busy all day long in the heavy routine at the chair, and when the day's work is over, they hurry home or to recreation which they very much need. It is surprising how few ever read their magazines, and when they occasionally do, it is not to read the articles bearing on this subject. When they go to meetings such as this, they are not found attending sections emphasizing health, preventive dentistry or children's dentistry. Consequently, we are going to have to carry the facts to them in more local and personal ways. We also have to win them to it rather than drive them to it. In my own state work, I consider meeting the local dentists or dentist one of the most important efforts of my task.

I am glad to note that some of our classes in dental economics are beginning to talk about dentistry as a health service. I trust that this is not a mere selling point and that the followers will not only sell health service but also deliver it. Certainly, no phase of dental service has so many good talking points in its favor. It ought to be much easier to sell than any other. I have no doubt about patients' being willing to pay reasonably for this service when its value is made clear to them and they are convinced that they can get it. When the dentist tries to sell real health service as intelligently as he now tries to sell complicated restorations and fits himself to give it and does give it, he is going to find some new satisfaction and so are his patients. Shouldn't there be more joy in preventing the need for bridgework than in making bridges? Wouldn't patients rather have small fillings than large ones? Wouldn't they rather have moments of the buzzer than hours of it? You can sell almost anything if you really and conscientiously believe in it, and dentists can sell health service when they get jolted out of the rut and catch a vision of its real worth. The dentist himself, in his daily intimate contacts, ought to be the best promoter of dental health education. He is in a position to demonstrate its real worth. Can he not show how the placing of small inexpensive fillings prevents the need for large, expensive and tedious restorations? Can he not demonstrate *why* it is important to start the child at $2\frac{1}{2}$ or 3; how pit and fissure defects occur and why these cause so much havoc in children's teeth, which can be prevented easily if taken in time; the many evil effects of mouth infection which preventive dentistry can forestall; the necessity for eliminating infection where neglect has brought it about? These and all the truths in dental health education can be demonstrated with the maximum of results right in the dental office. The trouble is that the dentist has been too much engrossed in selling merchandise to realize the possibilities and the satisfaction in selling service. In fact, when agencies outside his office have sold the health service, too often he "unsells" it when the patient comes to his office to have the work done. This is deplorable from every standpoint. It means that the efforts of our dental health programs are being nullified right in our own ranks. People ought to have confidence in their family dentist, but some are losing that confidence and more are going to if he doesn't wake up. Isn't it unfortunate that many of his patients are becoming wise in spite of him and not because of him? You know the usual result.

Dental health or children's dentistry as a specialty of dentistry is not the solution. There will be a place for a limited number of these specialties, but we cannot make much progress until children's dentistry and health service become the

commonplace rather than the exceptional in dental practice.

These, then, are in my opinion the greatest needs in dental health education: better dental health educational standards, putting first things first, free from bias and exaggeration and that conform to sound pedagogic principles.

Also of greater importance even right now is the education of the dentist, so that real dental health service will be more widely available; for, at present at least, and for a long time to come, the dentist is and will be absolutely necessary in the promotion of better general health through oral health. That, after all, is the real purpose of all dental health education.

A FURTHER JUSTIFICATION OF ORAL PROPHYLAXIS*

By CHARLES F. BÖDECKER,† D.D.S., F.A.C.D., New York City

ORAL prophylaxis needs little justification for those who have noted the improvement in the health of the oral tissues whenever it is applied. It undoubtedly decreases the incidence of dental caries and tends to keep the gingivae in a more healthy condition. Oral prophylaxis has, however, a further beneficial effect, which will be here detailed.

The mouths of the majority of civilized human beings are in an abominably filthy condition, unless oral prophylaxis is applied. This is certainly not a normal condition; for what animal living on its natural diet requires the use of a toothbrush or the services of a dentist to keep its mouth clean? H. W. C. Bödecker[1] has applied the term "physiologically clean" to the mouths of animals, and the belief is slowly gaining ground that the uncleanness of the mouths of civilized human beings results from an incorrect diet. Under our present conditions, therefore, oral prophylaxis is not only warranted but also absolutely necessary for civilized man.

D. D. Smith,[2] in describing some of the "remarkable results" of his system of prophylaxis, says: "It is also apparent that the tissues of the teeth themselves, specially the dentin and enamel, probably through stimulation of the vital forces of the pulp due to this treatment, begin a surprising change for the better; a change which is first and specially noted in improved *color* and general appearance. Dull, opaque tooth substance often loaded with offensive 'old ivory' pigment is transformed into clear, translucent tissue, the teeth assuming the appearance of living organs and having an impressive individuality."

A. C. Fones and others have made similar statements concerning the beneficial effects of prophylaxis on the enamel.

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

†Professor of Oral Histology and Embryology in Columbia University, School of Dental and Oral Surgery.

1. Bödecker, H. W. C.: Physiological Clean Mouth, Dent. Cosmos, 68:425 (May) 1926.

2. Smith, D. D.: Systemic Infection Due to Natural Teeth Conditions. Trans. County Med. Soc., Jan., 1903.

Almost all laboratory investigators considered such statements absurd, for it is claimed that enamel once formed has no connection with the pulp and therefore cannot be influenced by the condition of this organ or the condition of the body.

New researches concerning the cause of dental caries appear to substantiate this claim and show in what manner oral prophylaxis is beneficial to the enamel.

A brief exposition of a theory evolved from these investigations, published in detail elsewhere,[3] is necessary to the comprehension of dental physiology and its bearing on oral prophylaxis.

Before discussing this theory, I wish to express my belief that certain results of polishing the teeth (good and possibly bad) have not yet been properly considered. The effect of friction on the enamel cuticle may have a bearing on oral prophylaxis, a subject which requires further investigation. The presence of the cuticle (or some such membrane), although denied by certain authorities, is indisputable as shown by a number of investigators (Gottlieb, Orban; Broder in my laboratory). Its resistance to acid is claimed to be considerable by others, who consequently surmise that oral prophylaxis is harmful as it may denude the tooth of its protective covering.

Turning now to the old theory of the decay of the teeth and its bearing on oral prophylaxis, we find that we know comparatively little of the former phenomenon and less of its initial stages. The cause of this disease is believed to be an acid, formed by a certain type of bacteria which ferment the food on the surface of the teeth. The acid then dissolves the enamel and thus decay begins. Such a theory is incomplete, for it does not explain all clinical observations, such as:

1. Teeth do not *always* decay in the presence of food débris. Many persons never use a toothbrush; consequently, their mouths are in a filthy condition, and yet their teeth do not always decay. Other unfortunate persons clean their teeth five times a day in an unsuccessful attempt to stop decay. Therefore, the presence of food débris alone does not cause dental decay.

2. There appears to be an increase in the decay of the teeth during systemic illness and pregnancy. Personal habits usually are not changed perceptibly at such times and the care of the teeth is often a matter of increased precaution particularly during pregnancy, yet decay is usually greater.

3. Pulpless teeth appear to decay more readily than vital ones in spite of the fact that the former have usually been protected by the fillings on those areas most prone to decay (occlusal and approximal). Why should this occur if the cause of decay is purely from the exterior?

4. One of the approximal surfaces of two adjoining teeth sometimes decays, leaving the other intact. How could this take place if the destructive agent of the enamel is the acid formed from food débris, wedged between the two teeth? Does not this and the foregoing statement regarding decay of pulpless teeth indicate that each individual tooth possesses a resistance which originates in the interior?

There are other puzzling clinical observations regarding the decay of the teeth which cannot be explained by the older theory, but those above enumerated will suffice to show its inadequacy.

The active agent of destruction of the teeth may be an acid, aided by bacteria, but some further and as yet unknown

3. Bödecker, C. F.: New Theory of the Cause of Dental Caries, Dent. Cosmos, 71:586 (June) 1929.

factor must exist (as shown by the above unexplained clinical observations) which predisposes the teeth to decay. If once this weakening influence can be recognized and controlled, it is hoped that dental caries will be eradicated.

The new theory of dental caries satisfactorily explains the above enumerated puzzling clinical observations, and shows why prophylactic treatments have a stimulating effect on the enamel and dentin. It further considers the teeth as being an integral part of the body and indicates that they are often influenced by the health and ill-health of the individual.

This theory is briefly described below and is based upon the hypothesis that dental caries is dependent on *two* factors: (1) the primary (or irritating) cause, which is an acid on the surface of the teeth formed in the presence of bacteria, and (2) the newly added predisposing cause.

The practical advantage of this theory is that it satisfactorily explains the varying susceptibility of the individual to dental caries in the following manner:

If the individual is in a normal, healthy condition, the acid of decay is steadily neutralized by mineral salts, present in the tooth itelf, and thus this acid is made innoxious and, consequently, no decay takes place. These mineral salts are carried in a fluid which I have named the dental lymph, derived from the blood, which is known to contain various kinds of salts. One of the functions of these salts in the blood is to neutralize acid formed in the muscles (buffer power of the blood). As the dental lymph is derived from the blood, it is quite within the realms of probability that this fluid also contains mineral salts which have a like power of neutralizing acid and thus making the acid of decay harmless. In this manner, the teeth would be secure from the deleterious action of the acid, formed on their surfaces, for it would be constantly counteracted by the buffer power of the dental lymph, and, therefore, no decay would occur.

If, on the other hand, the individual is in an abnormal condition, the acid of decay is not completely neutralized, owing to an insufficiency of mineral salts in the dental lymph. It is thus free to attack the tooth, and decay results.

Let us now consider whether this theory will explain the puzzling clinical observations of the phenomenon of dental caries.

1. Teeth do not always decay in the presence of food débris. This clinical observation can now be readily explained in the light of the new theory. Unclean teeth do not decay in the perfectly healthy individual, on account of the presence of the mineral salts in the dental lymph, which constantly counteract the acid formed by such débris on the surface of the teeth.

2. There appears to be an increase in the decay of the teeth during systemic illness and pregnancy. Acidosis is known to cause a reduction of some of the mineral salts in the blood (a decrease of its buffer power), and this may have a like effect on the composition of the dental lymph in the dentin and enamel. Such a lymph would therefore be weakened in its power to counteract the acid on the surface of the tooth, the acid, consequently, being left free to attack the enamel, and thus the incidence of dental caries is increased, while the individual suffers from this disease.

If this theory is substantiated, it would indicate that there are few really healthy civilized persons in the world; which seems absurd. But we must remember that health is a matter of degree, in fact, a very marked degree, between the indi-

vidual bursting with energy and vitality, untiring and vigorous, and, on the other hand, the patient lying at death's door. It is common knowledge that a great percentage of civilized human beings suffer from slight chronic ailments, such as headaches and excessive tiredness. This very large proportion of individuals cannot be called really healthy. May not civilized people be suffering from some obscure ailment which reduces the amount of mineral salts in the blood and thus, among other evils, has a weakening effect on the teeth? Acidosis may be one of the ailments responsible for the increase in the spread of dental caries. This disorder is considered to be much more general than was previously supposed and, in its first and often intermittent stages, it causes but few grave symptoms. Whether other illnesses and pregnancy cause a similar reduction in the mineral salts of the blood, further investigations will determine.

3. Pulpless teeth appear to decay more readily than vital ones. This peculiarity can also be understood in the light of the new theory, as the loss of the pulp robs the dentin and enamel of its dental lymph. As a result, the acid of decay is not neutralized and can therefore readily attack such teeth.

4. One of the approximal surfaces of the two teeth sometimes decay, the other being left intact. Certain pathologic conditions of the pulp of the affected tooth can be responsible for reducing its flow of dental lymph. In this way, the acid on the surface of this particular tooth would not be sufficiently counteracted and decay would result.

Prof. Arthur Rowe, of Columbia University Dental School, called my attention to the fact that this new theory explains in what manner common table salt, when used as a dentifrice, may have a beneficial effect on the teeth. Sodium chlorid is known to increase osmosis, and therefore its use may have a stimulating effect on the flow of the dental lymph. An increase of this fluid, with its acid-neutralizing mineral salts, would result in an increased resistance of the teeth against the acid of decay.

Simple as this theory appears and feasible as it seems in its practical application, much work remains to be done. I am by no means dogmatic in my claim to have solved the problem of dental caries by the discovery of this predisposing cause, for I suspect that there may possibly be another factor besides acid and bacteria, responsible for the destruction of the enamel. This new theory explains for the first time all the puzzling clinical observations in connection with the decay of the teeth and it further shows the beneficial effects of the practice of oral prophylaxis. These investigations also indicate that the hard tissues of the teeth are in close metabolic connection with the body and are influenced by the general health of the individual.

The value of oral prophylaxis may now be considered to be twofold:

1. It keeps the teeth clean of food débris and thus reduces the amount of harmful lactic acid formed on their surfaces. The less acid there is on the teeth, the less mineral salts are required to be present in the dental lymph to neutralize such acid. An individual who is not completely healthy and who has an insufficient quantity of mineral salts in the dental lymph is greatly benefited by frequent prophylactic treatments.

2. Friction on the surface of the enamel has the further beneficial effect of stimulating the flow of dental lymph toward the surface of the tooth. An increased flow of the lymph with its mineral salts, through the dentin and enamel,

can better cope with and neutralize a greater amount of acid on the surface of the tooth. The danger of decay is therefore reduced by occasional prophylactic treatments, as these increase the resistance of the teeth to decay.

PREVENTION AS APPLIED TO ORTHODONTIA*

By FRANK A. DELABARRE, A.B., M.D., D.D.S., Boston, Mass.

AT this stage of the development of dental health service, it is evident that the responsibility must be divided if the child is to receive efficient attention. It is to be understood that the limitations of our work necessitate asking for medical cooperation also in many cases.

Our responsibility must be assumed by the dentist and orthodontist, because a child that has had the advantage of successful dental attention may still be badly handicapped by a malocclusion that seriously impairs the function of mastication, so essential to health. Again, if the child has a satisfactory occlusion and function, the presence of neglected tooth units results in the same situation. Consequently, the closest cooperation should exist between the two branches in caring for the child.

Wholly outside of the scope of this paper, two statements are made to avoid confusion in placing this responsibility:

It is evident to any one who has been connected with public school clinics that the purely dental side of the question cannot be adequately handled by specialization. The figures on occurrence of caries, abscesses, etc., in the mouths of even very young childen are so stupendous, staggering and disheartening that it is at once evident that the entire dental profession in the United States could make little headway in controlling these conditions if they wait for the child to attain the school age. Dental service must be applied early, and the responsibility rests squarely on the general practitioner.

Orthodontia does not, and possibly never can, serve all the cases that should be treated, because each case demands a high degree of technical skill and sound judgment, to be acquired only after intensive postgraduate study and training.

This is no argument against the practice of orthodontia by the general practitioner, provided he is equipped with the foregoing qualifications.

The main objective of our whole profession today is centered on the maintenance and preservation of general bodily health by careful attention to the local health. The dentist is responsible for the health of the units and the orthodontist for the functioning of those units.

Full orthodontic service should include attention to the following details:

First and foremost, observation of growth and development in the young child and the institution of orthodontic procedure as soon as possible after a positive diagnosis is made of an existing

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

malocclusion that impairs, or will seriously impair, function. It is there that his main effort is directed.

The technical procedure may result in securing a high percentage of functional efficiency, but it will not be permanent unless the closely related functions of breathing, speaking, mastication, swallowing, etc., are also placed on the same basis of efficiency.

All of the parts of this region are intimately related in all these various functions and each plays its part in every other. If one function is impaired, all will suffer. For instance, if mouth breathing persists after the correction of malocclusion, there is bound to be a relapse of some degree. Faulty tongue habits in speaking or swallowing will give the same results.

Briefly summarizing these items, the list includes:

1. The recognition of physical defects, such as nasal obstruction, tonsillar involvement, harelip, supernumerary or missing teeth, abscesses and decayed teeth, and proper attention, medical, surgical or dental, as a preliminary step.

2. Early recognition and elimination of faulty habits, functional or unnatural, overactive or passive. These include all the various sucking habits, posture habits in great variety and all the functional habits of the teeth, nose, mouth, tongue, lips, cheeks; in fact, all the parts involved in the multiple, interlocking functions of breathing, masticating, swallowing, speaking and changing the facial expression, as well as local and general posture habits, in repose and in action.

3. An estimate of the health quotient of the patient through observation and inquiry, in consultation with the physician if indicated. A complete physical medical examination is often desirable and may be recommended as a result of observation of the mental and physical attitude, the color of the skin, the height-weight index, and inquiry into the daily activities of play, work, study, rest, sleep, fatigue, diet, elimination, etc.

All of these have a direct and important influence on diagnosis, etiology and prognosis.

There are some matters in which the responsibility must be shared by the dentist and orthodontist, as follows:

1. Education of the parent in all matters pertaining to dental service, its necessity for the sake of health and the advantages of the preventive approach.

2. Education of the patient in the real purpose and benefit of the work and the need for cooperation and confidence in the operator for their own sake.

3. Education in home hygiene as a necessary step.

4. A definite understanding among the dentist, orthodontist and parent as to who shall assume the responsibility for office prophylaxis.

5. While complete responsibility for the detection of tooth defects logically rests on the dentist, the orthodontist can and should aid by referring the patient to the dentist for a special appointment if any such are discovered.

The orthodontist has asked for cooperation of the dentist in caring for the child, particularly through preventive effort directed at the initial defects occurring early in life.

He, in return, is anxious to cooperate in every possible way with the dentist, and if we both approach this difficult problem with the single purpose of child health in mind, and subordinate all else to that, everyone will share in the benefits.

520 Beacon Street.

"WHAT IS MOUTH HYGIENE?"*

By C. J. HOLLISTER, D.D.S., Harrisburg, Pa.

MOUTH hygiene, according to my conception, is divided into four parts: (1) prenatal diet; (2) diet and mouth care during the nursing period and up to adolescence; (3) (*a*) dental examination and treatment of deciduous teeth, (*b*) orthodontia and (*c*) dental examination and correction during the entire life, with restorations in accordance with the laws of hygiene; (4) public dental health education.

Prenatal Diet.—If the diet of the expectant mother is supervised until the end of the nursing period, and the diet of the child is properly balanced from the time it begins to eat solid food until the age of 12 years, it is possible to be assured of perfect bone and tooth development. Howe would agree to the foregoing statement, with the reservation, "Provided diet through the full span of life is balanced." My answer to that reservation is that if the child, during the first twelve years of life, had inculcated in its daily routine, proper food habits, he would, by force of habit, continue to observe the proper laws of living.

Diet and Mouth Care During the Nursing Period and Up to Adolescence.—"Train up a child in the way he should go and when he is old, he will not depart therefrom." The truth of this proverb is visualized often to us. To me, it is vividly evident in my own home. I have four daughters, ranging in the age from 12 down to 5. When my 12-year-old daughter was 18 months of age, I bought her a toothbrush. (I was eating three meals a day at home at that time.) I, personally, used the toothbrush in her mouth after every meal for over a year. She now has the habit firmly fixed, and as her sisters reached the age of 2, she acted as their teacher in the use of the toothbrush, so that, at the present time, their mother and I need pay little attention to our children, regarding their daily mouth hygiene.

What I have said concerning my family has been verified many times during my contact with service clubs, parent-teacher associations and other civic groups. I have had the father or mother come to me with the statement that their children, because of early training, have formed the almost unbreakable habit of cleaning their teeth after meals. Early childhood is the fundamental and logical time to train the individual. It is the obligation of the family dentist to impress on the parents the value of this early training. I do not feel radical in making the statement that, if there is proper childhood training, we have, to quite a degree, the solution of the dental caries problem. I will qualify that statement by saying that, of course, a proper dietary is assumed.

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Dental Examination.—Treatment of deciduous teeth: Under this heading, I will refer to my family again. At 18 months of age, my oldest daughter had her first experience in the dental chair. Since that time, to date, she has had a dental examination and necessary corrections at least twice yearly, and this procedure has been strictly adhered to with the younger children. As a result, I am able to state that none of my children have ever experienced a toothache, and the arches have developed normally, the deciduous teeth being shed as Nature intended. Again, none of my children have ever experienced a painful dental operation. This dental examination, together with the training and home care, has assured for each of them a normally functioning dental apparatus. True mouth hygiene during childhood, I believe, is well evidenced by this domestic incident. In addition to the immediate preservation of the child's teeth, these early and *frequent* experiences in the dental chair prove the old adage, "A stitch in time, saves nine"; at the same time, giving the child his first impressions of dental service without pain. You dentists in my audience know only too well the time and nervous energy expended in trying to relieve a suffering child during its first visit to the dental office. Very little or any of this suffering is necessary, if the child is taken to the dentist early and often, before the need is evident to the parents.

Orthodontia: Just a word on orthodontia fits into the mouth hygiene picture here. If the child is placed under competent dental supervision at an early age, the problem of combating pernicious habits can be more easily met, and if evidence of future irregularities begin to develop, this dental supervision, by consultation with the specialist in orthodontia, can much more easily prevent frightful deformities, which result, in many cases, in a condition which makes almost impossible the practice of mouth hygiene on the part of the individual later in life.

Correction during entire life with restorations in accordance with the laws of hygiene: The twice yearly dental examination, suggested for childhood, should be continued throughout life. Here, I wish to point out the absolute necessity of every practicing dentist's having an enthusiastic appreciation of mouth hygiene. If he does, he will continually impress on the patient the necessity for regular daily home care, and will, from time to time, check up on his patient as to whether or not he is using the proper methods of home care. Some of my friends in private practice make it a routine procedure, when a patient presents himself for a semi-annual examination, to give this patient, while he is seated in the chair, a new toothbrush, with the request that he demonstrate the method that he is using to brush the teeth. When necessary, the dentist corrects the technic employed and delivers a little lecture on diet. You can well recognize the value of such a procedure. If we ate exactly what we should, the way we should, the toothbrush would be unnecessary. Proof of this statement is to be had in observing the lower forms of animal life, in their natural environment. The teeth of wild animals are kept clean by the use of foods which literally scrub and scour during the process of mastication. Owing to the fact that the foods of modern civilization make this operation impossible in the case of human beings, is the use of the toothbrush not essential for daily home care?

The operating dentist, in his restorative work, will place every type of restoration with the sanitation phase well to the fore. For example, in preparing approximal restorations, he will exercise care to restore contact points. In placing crowns, bridges or partial plates, he will give first consideration to the proposition of cleanliness of these appliances. I have known quite a few private practitioners of dentistry who are conscientiously living up to the foregoing ideals, and all of these men enjoy the fullest confidence of their patients and are, at the present time, operating on a closed list of patients, at the same time enjoying a very remunerative practice.

Public Dental Health Education.—This is the one phase of mouth hygiene wherein the dental profession, as a whole, has yet to come into a full measure of efficiency. I make this statement from a background of quite a number of years' experience in the public health field. The individual dentist has yet to realize the great influence that he can exert toward this fundamental principle in controlling dental disease. If the private practitioner of dentistry would interest himself in the civic phase of his work, he could, by such interest, prevail on school boards and town or city councils to install educational preventive dental service to aid the children of this and coming generations, and again I may say, by reference to my own family, why should this not be done? My children, by training and dental supervision, are being insured of proper normal dentition, which, barring traumatic interference, will mean that they will have their teeth as a functioning apparatus throughout their lives.

In several instances, private practitioners of dentistry have sacrificed considerable time and effort to assist in the establishment of preventive dental health educational programs in their respective communities and have been almost entirely responsible, by their efforts, for the inauguration of such programs. While, in every instance, the spirit which prompted these men to give of their time was entirely one of service, they and the entire profession of their district profited by their efforts, not only in having more patients, but rather in working for an enlightened patient, who, through the public dental health campaign, had been brought to a better understanding and a greater appreciation of the value of dentistry; which proves the truth of the following quotation: "Serve and thou shalt be served; if you love and serve men, you cannot, by any strategy, escape remuneration."

Public announcements made during the past few months are an indication of a new era in public dental health work and dental research. Up until this time, relatively speaking, little money has been made available from the large fortunes of the country to dentistry, with the exception of the Eastman and Forsyth benefactions. The announcements referred to are those made by the Guggenheim Foundation of New York City that many millions of dollars will be made available in the near future to combat the dental problem, particularly among children in New York City; also, the announcement that Julius Rosenwald, of Chicago, was anticipating a large endowment for a similar service in that city. There is also a definite movement among the citizens of Philadelphia, a representative group of whom have already formed themselves into the Philadelphia Mouth Hygiene Association, for the purpose of providing educational and preventive service to the children of that city.

My friends, these announcements, to me, are a challenge to the dental profession of the entire country to do everything in their power, with their entire enthusiasm and ability, to aid in assuring the development of a practical preventive dental health program. The reason that this should be done is expressed by a dental application of the Golden Rule.

The men of our profession engaged in scientific research, collaborating with the medical group, have proved to us beyond a doubt the statements that I have made to you today. Is it not logical then, to state that the dental profession, with this information, should, from a humane standpoint, do everything in its power to bring about an ideal application of the fundamental principles of mouth hygiene?

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Xermostomia: Four cases of dry mouth are reported by William B. Chamberlain (*J. A. M. A.*, Aug. 16, 1930), who suggests a deficiency diet as a possible etiologic factor in the disease. In one case, the patient, a woman, aged 34, when first seen, in 1919, complained of excessive dryness of the mouth of eight years' duration. There was no saliva or mucus, and the patient did not perspire, even on exertion in extreme heat. The teeth, though well cared for, were soft and crumbling. There was a purulent discharge from Stenson's ducts. When seen more than a year later, the patient gave a history of abscesses in various parts of the body, and the next year, she complained of pus discharging from the sublingual glands also. The dental condition had grown worse. When seen next, in 1929, there was deafness and most of the teeth were gone. The patient related her history from childhood as characterized by very peculiar eating habits, her diet consisting solely of starchy foods (potatoes, pastries, bread with jam, etc.), with no fruits, meats, green vegetables, butter or milk. She had the usual childhood diseases, including diphtheria and scarlet fever, was for more than a year afflicted with boils, was subject to infection from the slightest scratch, developed acute indigestion, and had an operation for appendicitis, as well as a minor abdominal operation. At this time (May, 1910), she first noticed dryness of the mouth. Her teeth became so sensitive that she could scarcely eat and the pain became so intense that her dentist removed all the nerves, although there were no cavities. The teeth began to crumble and the mouth dryness increased. In 1916, the salivary glands began to swell, and pus could be pressed out. This condition continued four or five years. In 1921, after a severe case of influenza, the eyes were infected, red and full of pus, and the patient found that she had "no tears." She wrote Dr. McCollum at Johns Hopkins, telling him her history, including the restricted diet of her later years because of stomach ailments. Dr. McCollum placed her on a diet of orange juice, tomatoes, cooked greens of all kinds, raw vegetables, milk, cream, butter, whole wheat bread and some meat, and cod liver oil and calcium. The patient was unable to take the cream, butter and cod liver oil. In six weeks, the sight of the left eye, which had been only 14 per cent, had doubled and the inflammation had disappeared. The mouth did not improve, and after several attacks of neuritis and arthritis, all but seven of the teeth were extracted. Discharge of pus from the salivary glands continued. Her last complaint, before coming in because of deafness (May, 1929), had been "some sort of general poisoning resulting in arthritis," for which she was hospitalized in March, 1929. In the three other cases, all in women aged about 55, there was no history of deficiency diet, but the etiology was decidedly indefinite. The condition had been present four months in one case, one year in one and four years in the other. The mouth condition was much like that reported in the first case, but "bad teeth" were reported in only one case. One woman attributed the dryness of the mouth to the taking of some medicine, the nature of which she did not know, and in one case, the condition developed immediately after the death of a brother. Of forty-seven cases reported in 1922, in twenty-three, the etiology was not determined; three followed influenza; seven, psychic disturbances; three, sudden loss of teeth; two, swelling of glands; one each, nervous disorder, mumps, blow on head, pregnancy, a heavy meal and bad care of mouth, and two were attributed to the presence of stone. Possible causes are given in the literature as senile atrophy, psychic influences, disease of the medulla and the presence of stone. The author concludes: "In none of the reported cases has a deficiency diet been

mentioned as an etiologic factor. In my case, it certainly antedated the condition described. Whether the evident infection of the parotid preceded the atrophy and was therefore a causative factor, or whether it was an ascending one from the multitudinous flora of the mouth and gained access to the gland more readily on account of the absence of a descending current of saliva, it would be difficult to say. The latter would seem to be the more probable hypothesis since, in the absence of a current of saliva through Stenson's duct, bacteria could easily gain entrance to the gland itself."

Vis Medicatrix Naturae in Pediatrics: In his presidential address before the American Pediatric Society, Joseph Brennemann (*Am. J. Dis. Child.,* July, 1930) makes a plea that Nature be given a chance to exert her healing power, instead of being ignored or even thwarted. He says: "My thought shall be directed not to the possible eventual healing by nature, but to the obvious fact that she heals her own wounds at the time in the great majority of instances; that she has an elaborate and effective mechanism of defense and of offense against many of our ills which antedates by many thousands, perhaps millions of years, the medical, not to say medicinal, efforts along this line, and finally that we do not give her due credit for the part she plays and even thwart many of her efforts by doing things that are contranatural." With Holt and Mackenzie, he decries the fact that the doctor in private practice, the general practitioner, who has an opportunity to follow the same patients over long periods of time, so often fails to keep a record of his observations, or if he does so, fails to publish them. He quotes Mackenzie: "I . . . assert with confidence that medicine will make but halting progress while whole fields essential to the progress of medicine will remain unexplored, until the general practitioner takes his place as an investigator. The reason for this is that he has opportunities which no other worker possesses—opportunities which are necessary to the solution of problems essential to the advance of medicine." It is axiomatic with the observing practitioner that the majority of ills clear up without the aid of medicine, yet the medical schools leave the student with the impression, commonly shared with the laity, that disease requires cure rather than recovery, "something active from without, commonly from a bottle, rather than a restoration from within, often supported only by measures that promote comfort and insure rest and proper hygiene." Diseases for which there are specifics are of course, not here referred to. "It is a far cry from the frog's leg in the laboratory to the sick bed of a child. The intern and the young practitioner, with as yet no adequate sense of relative values such as results from practical experience, often try one drug or one therapeutic measure after another, and many of them never get over it. I confess that I often envy them their therapeutic resourcefulness. It is a great comfort both to the parents and to the physician to be able to think of something more to do, whether it promises anything or not, when all other measures have failed in a critical situation. The necessity of doing something is so deeply rooted in human psychology that it can never be quite ignored." The practicing physician is bombarded by the pharmaceutical houses and manufacturers of patent foods. The laboratory is regarded as a court of last appeal and its findings accepted in the face of clinical evidence to the contrary. Education of the laity, while desirable, may sometimes defeat its own purpose "through sheer volume and intensity." "In actual practice, the young mother with a nutritionally untutored mind who frankly states that she knows nothing about babies and leaves the instruction to me is a treasure; the mother who has specialized in dietetics while in college, or who approaches the subject with a McCollum in one hand and a Gezell in the other is sometimes more of a problem than is her baby." The author discusses anorexia, with which one pediatrician said that he had paid for his house. He advises the mother never to urge the child to eat. " . . . anorexia occurs most in the very homes in which vitamins are best represented. . . . It is a negligible factor in the orphan asylum, the convalescent ward in the hospital or in a camp except as a symptom of disease. The results of the experiments of Clara M. Davis in permitting children newly weaned to select their own diet makes one question the advisability of insisting on "an egg one day and a slice of bacon the next" or a quart of milk a day whether the infant wants it or not. Nature must be consulted more freely in regard to the matters of purgation and starvation in acute illness. The author questions the sense

of starving a patient just because he is sick, if he wishes to eat. In localized infections, Nature will often take care of the condition if she is given time to do so. The term "surgical interference" is perhaps more happily chosen than it was intended to be. In one case in which "everything" had been done for a child, the father, a physician, added "except to permit him to rest." The author concludes: "Above all things, I do not wish to appear as an iconoclast, and even less as a pessimist. I have questioned some conventional practices and trends in medicine; the practice of medicine itself stands unchallenged. Even in the use of drugs I have as little sympathy with the man who says there are only six or eight really useful drugs as I have with the man who uses all the pharmaceutical catalogs as his guide. I am today as enthusiastic a clinician, I think I might say therapeutist, as I was twenty years ago, but there is a therapeutic mellowness that comes with years of practical observation of the fallibility of so many once cherished and authoritative therapeutic procedures."

Primary Carcinoma of the Maxillary Antrum: A case of primary carcinoma of the maxillary antrum is reported by Charles E. Stone (*J. Indiana M. A.*, July, 1930) as illustrative of the fact that these growths seldom come under observation until time for the successful application of any treatment long since has passed. This is more especially true of lesions thus located because the growth is completely hidden, and when the case is seen by those who should be competent to recognize it, it is masked by a predominant inflammatory condition, which may lead to a diagnosis of empyema of the antrum or a polypoid condition. Another source of confusion is the fact that the pain is not characteristic but is practically always referred to the teeth. It is the author's opinion that if dentists and rhinologists would exert themselves to detect incipient cases of malignancy, much might be gained, as patients frequently are given palliative treatment for inflammatory conditions instead of surgical measures which would lead to biopsy and consequent earlier recognition. The tumor early causes irritation of the fifth nerve, with tingling or itching over the cheek and a sensation of pressure in the sinus. This usually sends the patient to the dentists, and a goodly number of teeth may be sacrificed without affording any relief. While this is going on, the size of the growth will be increasing steadily and hemorrhages or mucopurulent discharge from the nostril of the affected side will offer conclusive evidence that it is not the teeth which are at fault. Surgery is necessary to elimination of the growth, with subsequent irradiation; or the cautery is used, followed by radium salts or emanation introduced directly into the antrum. In the case described, a woman, aged 39, complained of intermittent pain and tenderness on the right side of the face, over the malar bone and around the right eye, with no particularly tender spot anywhere. She was referred to the author when the right side of her nose was found to be filled with polypi. The patient seemed in fair health and was cheerful. Externally, there was swelling over the maxillary antrum and an enlarged gland at the angle of the jaw. The mouth was normal, with no evidence of swelling or displacement of the hard palate. Transillumination showed that the right antrum was dark. The Caldwell-Luc operation revealed that the wall of the antrum was destroyed, and the sinus was full of granular material. The laboratory reported carcinoma. The patient lived seven months.

Association of Carcinoma of the Tongue and Syphilis: Clinical experience in the University Hospital in Ann Arbor, Mich., has generally confirmed the opinion of George H. Belote (*J. A. M. A.*, June 21, 1930) as to the frequency of the association of carcinoma of the tongue and syphilis. Data are presented to show the association of syphilis with cancer of the tongue as it has occurred in the university clinics over a period of five years. In ninety-two cases of cancer of the tongue, seropositive evidence of syphilis occurred in 29.3 per cent. Contrasted with a 5 per cent incidence in general hospital registrations and 7.2 per cent incidence in cancer generally, this figure establishes a definite close relation between syphilis and cancer of the tongue as a presumptive cause and effect. In the group studied, patients with syphilis developed cancer of the tongue on an average eight years earlier than did the nonsyphilitic patients. Leukoplakia as a forerunner to cancer occurred twice as frequently in the syphilitic as in the nonsyphilitic cases. The high incidence of syphilis in cancer of the tongue in the author's group did not hold true for female patients. If this group

should be left out, the incidence of syphilis and cancer would be increased to 34.7 per cent.

Cellulose Acetate for Maxillofacial Prosthesis: Dr. Vercing Lapierre made known recently before the Société de medecine of Lyons the use of a material for maxillofacial prosthesis which is said to be superior to substances heretofore employed, each of which has some objectionable feature. Metallic pieces are irritating to the tissues; porcelain is heavy and breakable; rubber is inflammable. Cellulose acetate has not these disadvantages. Compared with compounds with a gelatin base, it retains its shape and is unaffected by ordinary fluids and antiseptics; its lightness makes it superior to the metals, porcelain and even rubber. Its manipulation does not require special equipment. It can be used as plastic material for the formation of eyebrows, eyelashes or beard, and can be made to imitate closely natural conditions. The product is practically unbreakable by any force that is likely to be applied to it. The range of softening lies between 80 and 120 C., and combustion need not be feared. It emits inflammable vapors at a temperature of 260 C., and, under the direct action of a flame, chars and is extinguished spontaneously. Pure cellulose acetate is as transparent as glass. Fixed colors may be incorporated with it and are unaffected by light. The same colors may be used after the necessary retouching in imitating the tints of the skin and of the mucosae. The product can be worked with a file and may be easily polished.—Paris letter, *J.A.M.A.*, May 10, 1930.

Foreign Literature

Plastics of the Alveolar Crest (Hans Pichler and Richard Trauner, Ztschr. f. Stomatol., Vol. 28, No. 8, 1930): Different surgical methods are described by which it is possible to build a new and sufficient alveolar crest to make good retention of a denture possible. The indication for these operations is to be found in the lower jaw, when, after fractures or destruction of the bone, there is no alveolar crest present at all or when the remaining part of it is too small. It is necessary to cover the jaw bone with a layer of epithelium that cannot be moved from its base. The mucous membrane must be directly attached to the periosteum without loose submucosa. The authors secure this condition in different ways: They form a flap of the vestibulum and turn it over the bone after removing the submucous tissue; or they transplant small flaps of epithelium on the bone by free transplantation (Thiersch) and so form a solid epithelial lining on the bone. These operations have been performed after fracture of the jaws by a bullet. Other cases in which the plastic regeneration of a base for a denture is advisable are: bone defects after resection of the mandible and after osteomyelitis; large scars in the vestibulum which do not permit the retention of dentures; advanced atrophy of the alveolar process in which construction of plates is otherwise impossible.

Rudolf Kronfeld, Chicago.

New Findings Concerning the Epithelial Attachment (Wilhelm Meyer, Ztschr. f. Stomatol., Vol. 28, No. 8, 1930): Since Gottlieb's publication on this subject in 1921, it has been generally accepted that the epithelium is attached to the enamel surface in young individuals and that this epithelial attachment in young teeth ends at the cemento-enamel junction. Meyer, in 1929, published histologic findings on young human teeth, indicating that the epithelial attachment does not necessarily end at the cemento-enamel junction, but that the epithelium sometimes ends on the enamel, leaving a part of the enamel toward the cemento-enamel junction uncovered. In his recent publication, Meyer describes the findings on a jaw of a boy, aged 18. He shows that on almost all the teeth in this jaw, the epithelium ends above the cemento-enamel junction on the enamel. The apical part of the enamel is partially covered by cementum. These findings are an interesting contribution to the question of the relation between the epithelium and tooth surface. They indicate that the presence of the deepest point of the epithelium at the cemento-enamel junction might be due to a secondary process, as the end of the epithelium in earlier stages can be found farther up toward the crown.

Rudolf Kronfeld, Chicago.

The Marginal Valve on the Palatinal Plate of Upper Dentures (A. M. Schwarz, Ztschr. f. Stomatol., Vol. 28, No. 7, 1930): It is known that the suction of an upper denture depends on the close contact of the gums with the margins of the plate, which prevents the access of air underneath the plate. This

has been called the marginal valve. This marginal valve can be easily obtained in the vestibulum. More difficulties are usually found at the posterior end of the plate. Therefore, attempts have been made to extend the plate back to the so-called A-line, the borderline between the hard and the soft palate, where the tissues give a valve effect similar to that in the vestibulum. There are various objections to a routine extension of the plates to the A-line. The patients often complain that they are disturbed in eating and drinking by the length of the plate. Fortunately, we know from experience that many patients wear fairly short plates with good retention. This is due to the fact that the posterior margin of the plate gradually comes to be pressed down a little into even the hardest palatinal tissue, which causes the valve effect mentioned above. In order to increase the valve action of the posterior end of the plates, Schwarz suggests a slight modification of the plates. If the denture is found to lack suction at the posterior margin, a plaster base is cast for it. Then, as much plaster is cut away as is necessary to undermine the margin of the plate. With a hot instrument, the vulcanite is bent up slightly at the margin, thus forming a small ledge facing the palate. This ledge prevents the air from penetrating under the plate, good retention resulting.

RUDOLF KRONFELD, Chicago.

Experimental Changes in the Mesiodistal Relations of the Upper and Lower Arches (Carl Breitner, Ztschr. f. Stomatol., Vol. 28, No. 7, 1930): This publication is the continuation of a series of experimental orthodontic investigations on monkeys, the first part of which was reviewed in THE JOURNAL, June, 1930, p. 1190. The present article deals with the histologic changes following "jumping the bite." In the beginning, the author discusses the question as to how far we are justified in drawing conclusions from these experimental findings in animals for the conditions found in man. He shows that the bone changes in orthodontia occur exactly as they occur in human jaws. The "quality" of the changes is the same; whereas, the "quantity," or the "amount," of the changes may be different according to the difference in the relations between body size and forces. This is true for forces coming from the "outside" (ligatures on a monkey's tooth twisted by a human hand). But in a case of "jumping the bite" where no outer forces act on the tooth, but only the muscles of the individual, we have to expect changes that are consistent with the individual. Therefore, the changes found in a monkey in the latter case can be compared from the point of view not only of "quality," but also of the "quantity" of the changes. The author cemented metal caps on all the lateral teeth in both upper and lower jaws. These caps had oblique planes by which the lower jaw was forced forward when the mouth was closed. This experiment was carried on for forty-six days. The histologic sections showed bone changes in the joint. These changes indicate the presence of processes of tearing down and building up, tending toward a new position of the mandible in relation to the skull. The teeth that were used as abutments for the oblique planes show marked changes, crushing and hemorrhage of the periodontal tissues. They were evidently too weak to act as a fixed point; instead, they themselves moved.

RUDOLF KRONFELD, Chicago.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Memphis, Tenn., Oct. 19-23, 1931.

American Dental Society of Europe, Paris, France, July 29-Aug. 1, 1931.

International Dental Congress, Paris, France, Aug. 3-8, 1931.

Canadian Dental Association and College of Dental Surgeons, P. Q., Sixth Annual Fall Clinic, Montreal, October 16-18.

Chicago Dental Society, Midwinter Clinic, Feb. 2-5, 1931.

Greater New York December meeting for Better Dentistry, December 1-5.

Society for the Advancement of General Anesthesia in Dentistry, New York City, October 20.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

April (1931)

Kentucky, at Lexington (6-8).
New Jersey, at Atlantic City (15-17).

May (1931)

Iowa, at Des Moines (5-7).
New York, at New York City (12-15).

June (1931)

Wisconsin, at Milwaukee (9-11).

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

California, at San Francisco, December 13. Bert Boyd, Secretary, 610 South Broadway, Los Angeles.

Connecticut, at Hartford, November 17-20. Almond J. Cutting, Recorder, Southington.

Illinois, at Chicago, November 18-21. Horace J. Tharp, Secretary, 11112 S. Michigan Ave., Chicago.

Indiana, at Indianapolis, October 27-30. J. M. Hale, Secretary, Mt. Vernon.

Minnesota, at Minneapolis, December 12. W. H. Smith, Secretary, 2337 Central Ave., Minneapolis.

Massachusetts, at Boston. October 20-22. W. Henry Grant, Secretary, 146 State House, Boston.

New Jersey, at Trenton, December 1-6. John C. Forsyth, Secretary, 146 W. State St., Trenton.

Rhode Island, at Providence, December 2-4. Albert L. Midgley, Secretary, 1108 Union Trust Bldg., Providence.

Wisconsin, at Milwaukee, December 15-19. S. F. Donovan, Secretary, Tomah.

STATE OF RHODE ISLAND BOARD OF REGISTRATION IN DENTISTRY

A meeting of the Rhode Island Board of Registration in Dentistry for the examination of candidates will be held at the State House, Providence, Tuesday-Thursday, December 2-4, beginning each day at 9 a. m. Candidates shall present to the secretary of this board, at least one week before the examination, a written application on a form provided by the board, together with the examination fee of $20.

ALBERT L. MIDGLEY, *Secretary*,
1108 Union Trust Bldg.,
Providence.

NEW JERSEY STATE DENTAL SOCIETY

(Correction)

The next meeting of the New Jersey State Dental Society will be held in Atlantic City, April 15-17.

F. K. HEAZELTON, *Secretary*,
223 E. Hanover St.,
Trenton, N. J.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

BOARD OF DENTAL EXAMINERS OF CALIFORNIA

Examinations to secure a license to practice dentistry in California will be held in San Francisco, December 13. All necessary credentials must be in the hands of the secretary at least twenty days prior to the foregoing date.

BERT BOYD, *Secretary,*
610 South Broadway,
Los Angeles.

WISCONSIN STATE DENTAL SOCIETY

The sixty-first annual meeting of the Wisconsin State Dental Society will be held at Milwaukee, June 9-11, 1931.

E. E. PARKINSON, *Secretary,*
104 King St.,
Madison.

DAVENPORT DISTRICT (IOWA STATE) DENTAL SOCIETY

The Davenport District (Iowa State) Dental Society will hold its annual meeting, October 6-7, at the Blackhawk Hotel. Henry P. Boos, Minneapolis, Minn., will give a lecture on "Oral Survey to Establish Balance in Occlusion and Esthetics"; E. W. Howard, Des Moines, Iowa, will lecture on anterior porcelain jackets; R. C. Willett, Peoria, Ill., will speak on "Prevention of Malocclusion," and William A. Grey, St. Paul, Minn., will speak on "Prophylaxis and Pyorrhea."

L. J. EVANS, *Secretary,*
First National Bank Bldg.

TRI-STATE DENTAL CLINIC

The following men will appear on the program of the eleventh annual Tri-State Dental Clinic, which will be held in Memphis, October 27-30: George B. Winter, St. Louis, Mo. (exodontia); Clarence O. Simpson, St. Louis, Mo. (radiography); Walter T. McFall, Macon, Ga. (children's dentistry); James M. Prime, Omaha, Nebr. (operative dentistry); Paul A. Edmand, Chicago, Ill. (casting technic); Rupert E. Hall, Chicago, Ill. (dentures).

JAMES O. HALL, *President,*
Little Rock, Ark.

IOWA STATE DENTAL SOCIETY

The next meeting of the Iowa State Dental Society will be held in Des Moines, May 5-7, 1931.

JOHN SCHOLTEN, *Secretary,*
306 American Trust Bldg.,
Cedar Rapids.

WISCONSIN STATE BOARD OF DENTAL EXAMINERS

The Wisconsin State Board of Dental Examiners will hold an examination for license to practice dentistry in Wisconsin, December 15-19, at Marquette University, Milwaukee. For information, address

S. F. DONOVAN, *Secretary,*
Tomah.

ALUMNI SOCIETY OF THE DEWEY SCHOOL OF ORTHODONTIA

The annual meeting of the Alumni Society of the Dewey School of Orthodontia will be held at the Vanderbilt Hotel, Monday-Wednesday, October 27-29. An invitation is extended to all who are interested to attend this meeting.

H. K. COOPER, *President,*
626 Woolworth Bldg.,
Lancaster, Pa.
OTTO J. SORENSON, *Secretary,*
17 Park Avenue,
New York City.

GUEST CONVENTION OF THE ALAMEDA COUNTY DENTAL SOCIETY

The second Guest Convention of the Alameda County Dental Society (District No. 4), component of California State and the American Dental Association, will be held, October 2-3 in the Municipal Auditorium, Oakland. Lectures and clinics will be presented.

W. H. ROBINSON, *General Chairman.*

NEW YORK UNIVERSITY ORTHODONTIC STUDY CLUB

Organization of the New York University Orthodontic Study Club is announced. The purpose of the club is the furtherance of knowledge along scientific lines relating to the science of orthodontia. Membership is limited to the orthodontic faculty and graduates of the postgraduate course in orthodontics at New York University. At the organization meeting, the following officers were elected: President, Meyer Hoffman; vice-

president, A. J. Krasny; secretary-treasurer, S. William Singer; librarian, Samuel Hemley. Several interesting problems are being carried on by the members under the guidance of Frederick L. Stanton and Edward M. Griffin.

S. William Singer, *Sec'y-Treas.*,
350 Central Park West,
New York City.

OHIO STATE UNIVERSITY DENTAL ALUMNI REUNION

The Ohio State University Dental Alumni Reunion will be held at Columbus, October 31-November 1. For information, address

Dental Alumni Committee,
Hamilton Hall,
Columbus.

MASSACHUSETTS BOARD OF DENTAL EXAMINERS

The Massachusetts Board of Dental Examiners will hold an examination for registration for both dentists and oral hygienists in the City of Boston, October 20-22. Full information, application blanks, etc., can be secured at the office of the secretary, Room 146, State House, Boston. All applications must be filed at the office of the secretary at least ten days before the date set for the examination.

W. Henry Grant,
146 State House,
Boston.

GREATER NEW YORK DECEMBER MEETING FOR BETTER DENTISTRY

The sixth Greater New York December Meeting for Better Dentistry will be held at the Hotel Pennsylvania, New York City, December 1-5. The committee is preparing a program which will be both interesting and of high scientific value. Among the essayists will be H. E. Harvey, Norfolk, Va., Stanley D. Tylman, Chicago, Ill., Frank Fox, Philadelphia, Pa., M. S. Weaver, Cleveland, Ohio, W. J. Charters, Des Moines, Iowa, V. H. Kazanjian, Boston, Mass., W. H. Wright, Pittsburgh, Pa., E. N. Kent, Boston, Mass., and F. Blaine Rhobotham, Chicago, Ill. The meeting will be continued on the same plan as previous meetings, namely: $5.00 admits members to all lectures, clinics, etc. A subscription blank and list of clinics will be ready for distribution November 1. There will be a manufacturers' exhibit in the hotel during the meeting.

John T. Hanks, *Chairman*,
Charles M. McNeely, *Vice-Chairman*.

THE DENTAL SOCIETY OF THE STATE OF NEW YORK

The sixty-third annual meeting of the Dental Society of the State of New York will be held May 12-15, 1931, at Hotel Pennsylvania, New York City. A cordial invitation is extended to all dentists, members of the American Dental Association, and to all ethical Canadian dentists. John T. Hanks, 17 Park Ave., New York City, is chairman of the Exhibits Committee. Address Dr. Hanks for information relative to space and terms. Fred R. Adams, 7 West Fortieth St., New York City, is chairman of the Clinic Committee. Under his direction a new plan will be developed in the presentation of the educational clinics. Dr. Adams will be pleased to hear from ethical dentists willing to present clinics of merit.

For general information, address the secretary.

Alfred Walker, *President*,
100 West Fifty-Ninth St., New York City.
Dr. A. P. Burkhart, *Secretary*,
57 East Genesee St., Auburn.

NOTICE OF EXAMINATION FOR ENTRANCE INTO THE REGULAR CORPS OF THE UNITED STATES PUBLIC HEALTH SERVICE

Examination of candidates for commission as Assistant Dental Surgeon in the Regular Corps of the U. S. Public Health Service will be held at Washington, D. C., on November 10, 1930.

Candidates must be twenty-three years and not over thirty-two years of age. They must have been graduated in dentistry at a reputable dental college, and have had a total of seven years' educational training and practical experience. They must undergo a thorough physical examination and must satisfactorily pass oral, written, and clinical tests before a board of officers.

Successful candidates will be recommended for appointment by the President, with the advice and consent of the Senate.

Request for information or permission to take this examination should be addressed to the Surgeon General, U. S. Public Health Service, Washington, D. C.

PACKAGE LIBRARIES*

COMPILED BY AND AVAILABLE FOR CIRCULATION

FROM

THE LIBRARY BUREAU

OF THE

AMERICAN DENTAL ASSOCIATION
58 E. Washington St., Chicago, Ill.

Absorption of roots and bone.
Alveolar process—its structure, anatomy and resorption.
Alveolectomy.
Amalgam fillings and physical properties of amalgam.
†Anesthetics in children's dentistry.
Apicoectomy.
Articulation, occlusion and mandibular movements.
†Bacteriology.
Best time for orthodontic treatment.
†Blood count in focal infection.
†Bridges using inlays as abutments.
Business side of dentistry.
Cancer of mouth.
Cast gold inlays.
Casting gold, including inlays and dentures.
Cavity preparation.
†Child psychology.
Children's dentistry.
Cleft lip and palate—etiology and surgical treatment.
†Cleft palate—orthodontic treatment and prosthetic appliances.
Community and school dental service.
Comparative dental anatomy.
Condyle path movements.
†Congenitally missing teeth.
Contraindications in and untoward results from the use of local anesthetics.
†Contributions dentists have made outside their profession.
†Curetting.
Cysts.
†Deciduous teeth and their relation to permanent dentition.

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*Each package library contains information on one of the subjects listed and is composed of reprints, magazine clippings, etc., on that subject only. The packages are loaned to members of the Association for a period of one week after date of receipt. Unless the material is reserved for another borrower, an extension of time will be granted on request. The charge for borrowing a package library is 50 cents. The rental fee should accompany the request for a package library. No packages are sold. In response to requests, packages will be compiled on other subjects pertaining to dentistry.

†These packages contain less than the usual number of articles.

Dental assistants.
†Dental care of the preschool child.
Dental caries.
†Dental cements.
Dental clinics.
†Dental disease and practice in the tropics.
Dental economics.
†Dental erosion.
Dental ethics.
Dental hygienists.
†Dental nomenclature.
Dental health education.
Dental service in the World War.
Dentifrices.
Dentistry as a career and the status of the dentist.
Denture casting.
Diet and nutrition in relation to teeth.
Diet in pregnancy.
†Dry socket.
†Education of denture patients.
†Emphysema.
Endocrine glands in relation to teeth.
†Eruption of teeth and accompanying symptoms.
Esthetics in denture construction.
Ethyl chlorid.
Ethylene anesthesia.
Etiology of caries.
Etiology of malocclusion and preventive orthodontia.
†Etiology of pyorrhea and its relation to systemic conditions.
Evolution of human dentition.
Examination of the mouth and oral diagnosis.
Extraction of teeth.
First permanent molar.
Fixed and removable bridgework.
Focal infection.
Focal infection in relation to diseases of the eye.
Foreign bodies (of dental origin) in the lungs and esophagus.
Fractures of the jaws.
Full denture construction.
Gold foil.
Habits as factors in malocclusion.
†Hemophilia or excessive hemorrhage following extraction.
Hereditary influences in malocclusion.
†High frequency in dentistry.
†Histologic examinations of fractured roots.
†Histologic study of teeth and tissues.
History and progress of dentistry.
History of dentistry.
Hospital dental service.
†Hypercementosis and excementosis.
Impacted teeth and their removal.
Impacted third molars.
Implantation, replantation, transplantation of teeth.
Impression technic.
Impressions for inlays.
Indirect inlay technic.

Industrial dental service.
†Infection following extraction of teeth.
†Influence of diet on saliva.
†Influence of syphilis and fevers on tooth form and structure.
Interpretation of roentgenograms.
Investment compounds and technic.
Ionic medication.
Lectures to nurses.
Local anesthesia.
†Ludwig's angina.
Mandibular movements.
Materia medica and therapeutics.
Maxillary sinus and antrum—diseases and treatment.
Methods of sectioning and staining teeth.
Monson's theory.
Mottled enamel.
Mouth hygiene.
Muscle exercises and training in orthodontia.
Nitrous oxid-oxygen anesthesia.
Oral diagnosis.
Oral diagnosis with reference to roentgen ray.
Oral manifestations of systemic conditions.
Organized dentistry.
Orthodontia and its relation to dentistry and medicine.
Orthodontic appliances.
Orthodontic education.
†Orthodontic treatment of impacted cuspids.
Osteomyelitis of the jaws.
Partial dentures.
†Permeability of tooth structures.
Physical therapy in dentistry.
†Pinledge and pinlay attachments.
Place of extraction in orthodontic treatment.
Porcelain.
Porcelain inlays.
Porcelain jacket crowns.
Postoperative complications and care.
†Postoperative psychosis.
†Pregnancy and dental disease.
Preoperative examination of patients.
†Preparation of cavities with hypersensitive dentin.
Preventive orthodontia.
Procain (novocain) dermatitis.
†Program building for state and district societies.
Prophylactic odontotomy.
Pulp conservation including pulp capping and cavity lining.
†Pulp pathology.
†Pulp stones.
Pyorrhea.
Relation between dental conditions and mental health of insane.
†Retrusion of the mandible causing impaired hearing.
Root canal treatment.
School dental service.
Should dentistry be advertised?
†Status lymphaticus.
Sterilization of dental instruments.

Stomatology.
Studies of saliva.
Suggestions for a talk to mothers.
†Supernumerary teeth.
Surgical treatment of pyorrhea.
Three-quarter crowns.
Tooth arrangement for full dentures.
Toothbrushes and toothbrush containers.
Toothbrushes, tooth pastes and mouth washes.
Traumatic occlusion.
Trigeminal neuralgia.
†Tuberculosis and dentistry.
Ultraviolet ray in the treatment of pyorrhea.
Ultraviolet ray therapy in dentistry.
Use of elevators in extraction.
Value of dental service in schools.
Value of roentgen-ray examinations in orthodontia.
Vincent's infection.
Wax expansion method.

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1930-1931

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